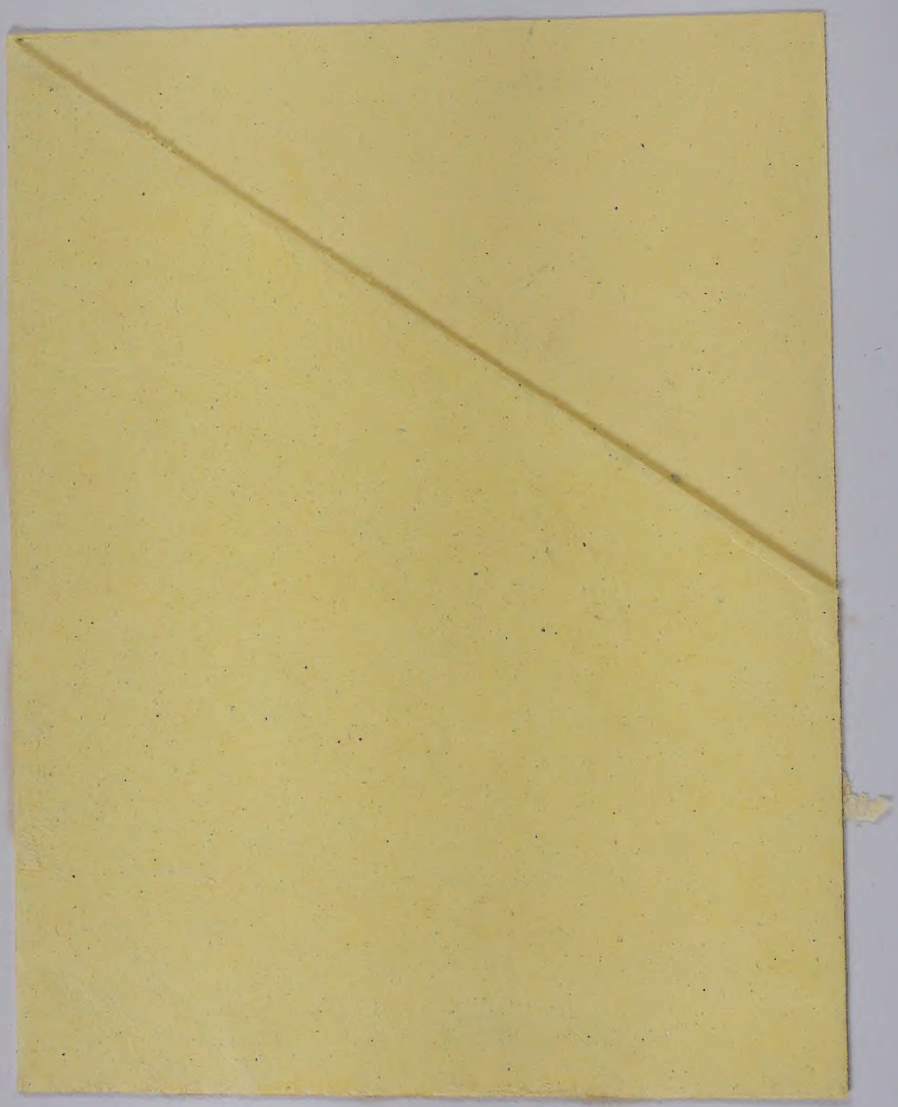
It is time...

TOWARDS
PEOPLE'S SCIENCE MOVEMENT



IT IS TIME.....

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PREFACE

The People's Science Movement is one of the most exciting developments of the last decade. Scientists, college and school teachers, middle-class Government employees and indeed people from all walks of life have found in this movement a scope for making a positive contribution to the process of social change.

The People's Science Movement seeks to make people aware of the method and values of science and of the wonders of science. It seeks to examine the relationships between science and society and make people aware of and involve in the processes by which decisions concerning developmental strategies are made. For the PSMs, science is no mere collection of information. It is an active vehicle of social change.

In pursuit of these objectives, activists involved in this movement have worked in writing, publishing and selling a wide variety of popular science books and periodicals. They are involved in science education: writing text-books, designing curricula and new pedagogical techniques and actually training hundreds of teachers and teaching themselves. They are involved in various varieties of non-formal education using a wide variety of media from folk art to video and now in the literacy campaigns. They are active in safeguarding health and environment, not only by education but even by leading agitations on specific issues. They are involved in research and documentation, in the presentation of critiques of national, regional and local developmental strategies and even in contributions like improving village-level technology with scientific inputs and organizing co-operatives.

Yet few activists have had the opportunity to be exposed to all the various types of work and experiences. Fewer still are aware of the various theoretical discussions and ideological and philosophical streams from which these movements arose and have continued to grow. This collection of papers is meant to help the PSM activist understand the ideological and theoretical background of many attitudes and activities of the PSM movement. But we are sure that many more people outside the sweep of the PSMs will be interested in the issues raised in these discussions.

We would however caution the reader on two counts. First, it should be clearly understood that the papers published are part of an ongoing, active discussion and not the final opinion of any group including the Pondicherry Science Forum and Tamil Nadu Science

Forum. We have chosen to publish it now, to serve as course material for our first annual activists' training workshop - the 'Living with Science' Camp, to be held at the Dt. Science Resource Centre, Pondicherry from May 15 to 24th 1989. We are sure that many more camps and workshops will find this book as a useful guide.

Secondly, it must be understood, that theoretical discussions are no substitute for real living experience and indeed such theory can be understood only in the context of the experience of PSMs over the last twenty years. Unfortunately few PSMs have documented their experiences adequately. To understand the scope and sweep of PSM activity, the reader has no option but to meet, discuss and involve oneself in this vigourously alive, social movement.

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HUMANITY AT THE CROSSROADS

Towards A People's Science Movement

Dr. M.P.PARAMESWARAN

It is time
to start a liberation struggle,
liberation from dependence,
liberation from ignorance,
liberation from mistrust and hatred,
It has to be a self - reliance movement,
a literacy movement,
a unity movement.

India is a big country. It is second largest in the world, second only to China. It has an illustrious past. Four thousand years ago, our forefathers built the beautiful cities of Mohenjodaro and Harappa on the banks of Indus. Aryabhatta, Brahmagupta, Varahamihira, Charaka, Susruta..... are great names in Indian astronomy, mathematics and medicine. They all lived more than 1500 years ago.

All this was long ago. Today India is a poor country. More than half of its eight hundred million people are very poor. They are clothed in rags. They live in most unhygienic conditions, in shelters not fit even for pigs. More than sixty percent of our people are illiterate. Nearly half of the lepers in the world live in our country.

Same is the case of persons afflicted with tuberculosis, malaria, filaria, cholera, blindness, skin diseases etc. In the developed countries all these diseases have been almost eradicated. Peope are well fed and well clad. Most of them live in decent dwellings. Literacy is close to hundred percent. Life expectation is high about 75 years. Infant mortality is extremely low.

Why so much difference? Why did India which used to be so much ahead of these nations only a few centuries ago, fall so much behind?

One important reason is the failure in the application of science and technology to the organization and execution of production. The single major cause for this failure is the colonial subjugation of India by the British.

Unlike other animals, human beings live by consciously transforming the nature around it, by producing food, clothing, shelter and other necessities of life. The actual process of intervention with and transformation of nature results in more and more new experiences. Individual members and groups of societies the world over go on accumulating this experience from generation to generation. Science and technology has born out of this collective experience. It has grown through constant application.

Ten thousand years ago the only occupation for humanity was to run for food and to run away from being food to beasts of prey. Even with a full day long food hunt, often they went hungry. Their only concern was to exist, to resist death. This was not easy. Their number was very small.

However, today humanity can produce all its basic needs with very little effort. Advanced nations produce all the food they require and even more by making use of less than ten percent of their work force. In India we produce, on an average, 1.5Te of rice, or 6Te of cabbage or 10Te of tomato per hectare, Australia produces 5Te of rice, Belgium produces 115Te of cabbage and Denmark produces 265Te of tomato per hectare. Such is the difference in productivity. The same is the case with industry. The workers of industrially advanced nations produce industrial goods several times of their internal requirement, using only 30-40 percent of their work force. They can produce many times more per worker or per unit quantity of raw material. In fact human-kind can produce all the necessities and comforts of life by expending less than three or four hours per day on an average. The increase leisure time is available for them to enjoy the cultural heritage of humankind world over.

The accumulated knowledge about the nature around us, from fundamental particles to the infinite universe, from the basic building blocks of life to the most complicated life unit, the human brain, is so great that humanity can be really free from the mundane worries of existence and can develop in a large way all that is HUMAN. Humanity stands on the threshold of liberation, liberation from all animal limitations.

This is the potential of the knowledge about law of nature, potential of science and technology. But there are very many obstacles in the realization of this potential. Basically, all of them, stem from the manner in which human society is organized. Realization of human potential demands successful integration of human skills, tools and raw materials. It also demands continuous upgradation of skills and equipment, continuous upgradation of technology. Human society, organized as it is today, has got severe limitations.

The world is at crossroads. Human civilization is at cross roads. One road leads to war, to total destruction, to hell. The other leads to liberation, to heaven, of course on this earth itself. We have to make the choice, each and every one of us individually and collectively. There are forces acting within, which are pushing humanity along the road of destruction. We have to recognize them and resist them. There are, also, forces which are trying to lead humanity towards peace and progress. We have to recognize them and strengthen them. An economically strong, intellectually integrated and emotionally united India can go a long way in strengthening these forces. But today India is economically weak, intellectually fragmented, and emotionally divided. Our industry, our agriculture, our health, our education and even our culture have become dependent on others.

Upto the beginning of 19th century India used to enjoy a commanding position. Her industry, though village centered, used to be more powerful. The advent of the British, their colonial rule and the use of more powerful technology totally demolished the base of Indian industry. Industries that began to develop since independence, also are being systematically maimed. Most of the small scale industries in India are sick. Mortality rate among them is very high. Even many of the big industries, Especially public and joint sector industries are sick and on the verge of death. Are we not on the brink of becoming a colony again?

The middle class and the affluent class are slaves of consumption goods aggressively promoted by multinationals and Indian big business. They wean the best which the country can't digest. We go on importing. We allow foreign and deshi big business to destroy our industries which may be producing goods which are slightly inferior to foreign goods. Even industries which produce equally good or better goods are being subverted by the multinationals. Today we stand on borrowed legs. We are dependent. This has to change. We have to stand on our own legs. Long ago Gandhiji had taught us this. But we have forgotten this. It is time to start a new liberation struggle liberation from dependence.

Science and Technology can play an important role in this.

* It helps us to realize the human potential. It can give us a vastly improved quality of life.

* It can upgrade human skills and also resources. But it may be noted that under present conditions, introduction of science and technology can, in a number of places lead to aggravation of inequality and degradation of resources available to the large masses.

* In order to prevent this from happening people have to intervene and they should be capable of doing this. People should play an active role in the shaping of the science and technology programme for their own advancement.

* It is the social responsibility of scientists and technologists to fulfil the aspirations of the people.

India has a glorious past. We had made significant contributions to the fund of human knowledge, not only during ancient periods but also during recent times. Contributions of Srinivasa Ramanujan. C.V.Raman, Jagdish Chandra Bose, Satyendra Nath Bose, Hargobind Khoranna, S.Chandrasekhar, to mention only a few, are by no means insignificant.

But today we are a divided nation, brothers fighting brothers in the name of religion, caste, language and culture. We have got enemies. They don't want us to remain united. They want to destabilise India. They cast their net far and wide. The meshes are close. There are a thousand and one hooks. Emotionally sensitive people get easily entangled. They are injected with the poison of anarchism. In India there exist tens of thousands of small groups, of very sensitive and honest people. Most of them are funded by foreign agencies. They are oblivious to the fact that the sum total of their personal sacrifices is only intellectual fragmentation and emotional anarchy.

Many are infected with inverted notions of caste, religion, language and culture. Harijans against non-harijans, Hindus against Muslims, tribals versus non-tribals. Men and women are pitted against their brothers and sisters. These differences are to be dissolved in the common heritage of humankind to which various people have contributed at different historical stages. Human species is one. Whatever may be the race, language, religion, culture or nationality human biology is the same. Science teaches us this. It has the potential to become the great unifier of humantity.

However we have got a long distance to travel before realizing this potential. Today humanity is divided into a number of countries. This is besides the divisions, within each country, based on caste, class, language, religion etc. The countries of the world can be broadly classified into three groups - the socialist countries, the industrially advanced capitalist countries and the under - developed countries. The rich capitalist countries continue their exploitation of the poor countries, their erstwhile colonies. The gap between the rich and the poor is widening. This is true not only between nations but also within nations.

Since independence India has grown, but in an uneven way. There were poor and rich at the time of independence. Today there are many more poor people whereas the rich have become immensely more rich. Their luxurious living is beyond imagination. Palatial buildings and five star hotels have been mushrooming. So is the case with slums. The rich want the best in the world. And our country cannot digest it. Ordinary people have to pay the price of the gluttony of the rich. Economic and industrial policies designed to satisfy the avarice of the rich ruin the industries which provide employment to the poor. Our society is gradually getting divided into two hostile camps - a large majority which is continuously being improverished or facing the threat of impoverishment and a small minority which gets enriched continuously. This minority wields considerable power. It has command over the natural and human resources of the nation. Its command over science and technology, its control over the state apparatus and its collusion with the agents of fragmentation make it powerful.

The impoverished majority has been resisting this. The exploited poor mount revolt against the exploiting rich. The oppressed harijans revolt against the oppressing high castes. Various forms and tools of struggle have evolved over decades and centuries. Popular or people's movements like trade unions, political parties, organizations of

peasants, of youth, of women, of students are all forms of this collective resistence.

The second half of 20th century saw the emergence of new forms of collective resistance. Some are based on environmental consciousness, some based on the understanding of the qualitatively different role science and technology is playing today and of the importance of this understanding for other collective actions. During the past two decades,environmental groups have sprung up in almost all developed countries and a number of developing countries. The environmental groups in Europe, especially those resisting nuclear energy and nuclear arms are very strong. One of them, in West Germany has turned itself into a new political party called 'Green party' and secured considerable votes in the election. Sahabat Alam Malayasia is a strong environmental group in the far east. There are a large number of environmental groups in India too. One feature common to most environmental groups is the absence of interest on other aspects of society and lack of understanding about the relationship between socio-economic system and environmental problems.

A number of science popularization organizations came into existence in India just before and after independence. The Bangeeya Vijnan Parishad founded by Satyendra Nath Bose, the Bijnan Prachar Samithy of Orissa, the Assam Science Society etc. are some of them.

The other category of organisation looks into the entire spectrum of science and technology and its inter-relationship with the socio economic system. The "Science for the People" group of USA, the "Radical Science" group of UK etc. are examples of this category. Quite, different from all these is a new group of organizations called 'Peoples Science Movement". This form is only, perhaps, less than a decade old and was first used to denote the Kerala Sastra Sahitya Parishad, which has entered, this year, into its Silver Jubilee Year. During the past few years a number of other PSMs have emerged and have begun to grow. The Karnataka Rajya Vijnana Parishad, the Tamil Nadu Science Forum, the Pondicherry Science Forum, the Delhi Science Forum, the Lok Vijnana Sanghatan etc. are some of them. These PSMs are interested in the entire spectrum of societal activity, education, health, energy, irrigation, land use, transport, environment, forest.... literally in everything. Today, there is no human activity which is not influenced by science and techonolgy. They also recognize the inter-relationship between the nature of the organization of the society and the application of science and technology for solution of societal problems. They understand clearly,

that application of science and technology can have differential impacts on different sections of the society.

They had taken up issues like pollution of water courses, occupational hazards, sale of harmful and banned drugs, peoples' health policy, deforestation, rational industrialization etc. Wherever conflicts of interest crop up they take stand on the side of the suffering majority. Most of them are not dependent on govenment or any other agency for their existence.

During the past four or five years there had been several occasions for them to meet each other and work together. Activists from one group are able to establish relationship with kindred souls in other groups and a sort of brotherhood has been growing. The Bharat Jan Vignan Jatha which recently concluded was a gradual outcome of this process. It was a massive effort involving several thousand workers. Scientists, science popularizers and teachers, all participated in this effort. Five such groups, one each from Madras, Solapur; Srinagar, Calcutta and Dibrugarh, consisting of people drawn from various states set out on 2nd October 1987 the Gandhi Jayanthi Day, on the Bhart Jan Vignan Jatha. Covering a distance of about 5000-6000 kilometeres and traversing a number of states each Jatha reached Bhopal on Nov. 7, the birth day of the great and patriotic Indian Scientist C.V.Raman. Each jatha had three components: a pilot component, a scientist component and an artist component. They held science exhibitions, delivered slide lectures and showed films on science. Renowned scientists accompanying the Jatha addressed gatherings at various places. Besides that, several thousand lectures were delivered and seminars held throughout India, primarily on subjects like science, self-reliance, the importance of our public sector undertaking, the necessity of protecting and promoting Indian Research and Development by actually making use of them; the role science, in its broadest sense, can play in strengthening national integration, of the importance of eradication of illiteracy in safeguarding our freedom and strengthening our unity etc. etc.

Any Jatha Should have a set of slogans. Jan Vignan Jatha too had its slogans,

Science for the People
Science for the Nation
Science for Discovery
Science for Self - reliance
Science for National Integration
Science for Knowledge

Science for Peace
Science for Basic needs
Science for Food
Science for Clothing
Science for Shelter
Eradicate illiteracy
Basic needs for all
Food for all
Clothing for all
Shelter for all
Health for all

It is time to start a liberation struggle, liberation from dependence, liberation from ignorance, liberation from mistrust and hatred. It has to be a self-reliance movement, a literacy movement, a unity movement.

We do not want to enter the 21st century as a nation with the largest number of illiterates in the world.

We do not want to enter the 21st century as a nation with the largest number of hungry people in the world.

We do not want to enter the 21st century drenched in the blood of our brothers.

We do not want to enter the 21st century as a nation taken over by multinationals.

* We have to take the pledge. We will eradicate poverty and exploitation. If we have the will we can achieve it. Let us will so.

* We have to take the pledge. Illiteracy will be eradicated in this century. If we have the will we can achieve it. Let us will so.

* We have to take the pledge. All disputes based on border, on language, on religion, on water will be resolved and that we will resist as one nation all attacks on its culture, on its economy or on its territory. If we have the will we can do it. Let us will so.

* We have to take the pledge. We will go swadeshi, we will not be deceived by the glamour of foreign, we will patronize our public sector undertaking, our deshi industries. If we have the will we can do so. Let us will so.

It is time for all of us to raise questions, a number of questions:

Why? Why? Why?
The rainbow in the sky

And stars twinkling high
Why? Why? Why?
The lily is white
And the rose is red
Why? Why? Why?
The tiny little firefly
carrys a torch beneath its belly
And why my cat does not fly
Like crows and pigeons in the sky?
And why don't the mango laugh and flutter.
Like the sparrows and squirrels on the tree
Why? Why? Why?
The timber thieves are cutting clean
All the trees on the mountain green
Why? Why? Why?
These little eyes are full of tears
And devoid of cheers?
Why? Why? Why?
Do Ramoo and his ma
Go begging on the streets
Why? Why? Why?
People do kill each other
In the name of caste and religion?
Why starvation?
Why poverty?
Why ignorance?
Why? Why? Why?
It is time to raise the question
Why?
Wherever there is injustice
There, everywhere
With an upright head,
Without fear or fright
Thunder:
Why? Why? Why?

Dr.M.P.Parameswaran is one of the founder members of the Kerala Sastra Sahitya Parishad and now the national convenor of the All India People's Science Network. An engineer by qualification with a doctrate in nuclear engineering from Moscow Power Institute, he gave up his career in BARC to concentrate on KSSP work. His pivotal role in PSM activity has won him recognition and respect from very wide sections of the people as well as the NCSTC instituted national award for science popularization.

PERSPECTIVE OF THE BJVJ

The proposed All-India Science Jatha will seek to bring to the people the message that science has placed before humankind, tools which can radically change our lives. Science enables utilization of what appear to be elemental forces of nature because it provides knowledge and understanding of natural phenomena. Victory over disease, a clean and decent habitat, production of basic necessities of life are within what is achievable using existing knowledge and technology. Yet, quite often, the drive for excessive profits and reckless exploitation of natural resources utterly disregards the vital interests of the people and contributes to severe degradation of the environment. The belief that the people at large are incapable of understanding the implications of science and technology, is a myth fostered by the elite in order to preserve their own control. This control alienates science from the people and also ignores historically accumulated empirical knowledge of the people. The Jatha seeks to bring to the people a fuller awareness of the potential of science and to actively involve them in the movement to link science with the people.

The Jatha would choose and propagate themes whose content bring out the following:

a) Understanding of the method and values of science, its sence of wonder, creativity and excitement in comprehending the world around us.

b) Science and technology upgrades resources and skills. Under present conditions of its introduction, however, it is associated with the aggravation of inequalities and the degradation of resources used by the masses at large.

c) Stimulation of the desire in the people for active intervention to prevent misutilization of science and technology.

d) Mobilizing people for shaping science and technology development for their own advancement.

e) Enhancing the social responsibility of scientists and technologists to fulfill the aspirations of the people.

f) Values and knowledge from science bring out the common identity and destiny of the human species, and contradict and negate communal hatred pitting one section against the other.

g) Science is the common heritage of humankind to which various peoples have contributed at different times and under certain historical conditions. Contributions by the Indian people are part of this world heritage.

h) Contemporary achievements and innovations of scientists technologists and others towards self-reliant development of the nation.

i) Realization of full potential of science and technology for improved quality of life of the people require a participatary mode of development.

26 leading organizations involved in science popularization came together in 1987 to organize the historic Bharat Jan Vigyan Jatha (BJVJ). They have since constituted themselves into the All India People's Science Network. This statement published above is the first joint expression of the perspective of the people's science movement (PSM) adopted jointly by all the various PSM groups, when they came together to organize the Bharat Jan Vigyan Jatha.

SCIENCE COMMUNICATION

BY PONDICHERRY SCIENCE FORUM

PART - I

1. INTRODUCTION :

Science is essentially a social activity. It is therefore different to imagine any aspect of science that does not involve communication. The attitude towards science and the major part of scientific knowledge that even the most active of scientists acquire, is acquired passively. That is, by reading about it or listening to lectures etc. Only a very small part of it is acquired by himself or even verified by experience. Science communication thus plays a major part in scientific 'Perception' - the attitude towards science, the understanding of science and the use to which it can be put.

2. SUBSETS :
a) amongst scientists
b) science education
c) to administrators
d) common man - the public (popular science).

'Scientists are disposed in their thinking by a general background, or tacit infrastructure of ideas, concepts and knowledge. In addition they constantly engage in a form of internal dialogue within the whole structure of their particular discipline. In this dialogue a scientist raises questions and meets points of view which are attributed to other scientists and to his or her own past work. In addition to the internal dialogue, scientists are actively engaged in their daily work with a social exchange of ideas and opinions through discussions, lectures, conferences and published papers. Motivations, questions and attitudes arise out of these dialogues, so that all scientific research, in the end, arises out of the whole subcultural matrix of science'. (Science, Order and Creativity by David Peat and David Bohm)

It has been shown by a number of authors that blocks in the communication of science between scientists in different specialities for instance, or between scientists of one school or another, or between scientists in a particular field who use a different set of meanings for the same terms or a different frame of reference; all lead to serious blocks in the 'perception' and thereby progress of science.

If communication of science has such a vital role to play in the community of scientists, in the process of the creation and understanding of science by scientists, the role of science communication in the 'perception' of science in the whole community is no less. Indeed it is a crucial one.

This paper largely confines itself to this aspect of science communication - communication of science by scientists and non-scientists alike to the public, to the community at large - or what has largely come to be called as 'popular science' or 'popularisation of science'.

Again this paper does not deal with two major subsets of science communication.

a) Formal science education, that is, teaching of science in the schools and in the universities and as we are often apt to forget it - in the polytechnics and industrial training institutes.

b) Science communication to select groups like planners, politicians, industrialists, administrators and a number of persons where scientific input is critical to the performance of their duties and the decisions taken - though most are not professional scientists.

Both the subsets are largely dependent on the general attitude to science teaching and to science prevalent in society, but besides this, they are affected by a wide variety of influences and pressures that need examination in depth - not only because of their specific differences from 'popular science' as we have understood it but because they play a vital role in the 'perception' of science and its utilization in society.

3. POPULAR SCIENCE :

The GAP BETWEEN ADVANCEMENTS IN SCIENCE AND IN SCIENTIFIC CONSCIOUSNESS.

The impact of science today is universal in a way that it never has been so far. Yet popular understanding of science and a scientific consciousness lags far behind.

The material contribution of science in the form of inventions and appliances present themselves to the average person not so much as contributions of science but as extensions of things which existed before science - passive tools of extending man's capabilities. Thus in most cases the use of scientific appliances does not require much, if any scientific knowledge and no acquaintance at all with the scientific method. A child tuning a radio, a computer programmer

writing and feeding in a programme, a factory worker operating a machine, a farmer driving his tractor - all have only the vaguest idea of how the equipment operates but they have no difficulty in getting their jobs done. Talking on a telephone is merely an easier way of talking to persons without having to go all the way. Visiting the doctor for giving one's child an immunization injection is an easy (and almost magical) way of keeping healthy.

The workers in a nuclear power station see no contradiction between their daily work and in observing 'Ayudha Pooja' with the fervent belief that it is necessary for the well-being of their plant and themselves. Nor will an administrator think twice about finding the auspicious time for a rocket launch. At a larger level in a country, networked and crisscrossed by roads, railways, airports, wireless stations, power lines and satellite centres, caste and commmunal strife, glorification of sati and opression of women continues.

4. IMPACT OF THE GAP ON SOCIETY :

Exactly 50 years ago, in J.D.Bernal's landmark book 'Social functions of Science' he writes, "There is no getting away from it. To a large extent science has become detached from popular consciousness and the result is very bad for both. It is bad for people at large because living in an increasingly man - made world they are gradually falling behind in their awareness of the mechanisms that control their lives. At the bottom, there is not very much difference between a savage with his complete ignorance and helplessness before the natural phenomena of drought or disease and the modern man before the man - made disasters of technological unemployment and scientific warfare. Faced by the unknown he turns to fantastic and mystical explanations. It is no accident that the present age has seen the recrudescence of superstitions such as astrology and spiritualism which it was thought had been well dead at the end of the middle Age. The far more dangerous grip which demagogic and fascist ideas (read fundamentalist, communal, obscurantist ideas also, now 50 years later) can exercise is a measure both of popular ignorance and the need to have something to believe". (text in parenthesis added by us -author).

The gap between scientific awareness and science has other consequences. Science has advanced to a level where it has opened up tremendous new possibilities - and dangers. Any appreciation of the results of science and its possibilities would defenitely lead to a more direct involvement of people not only in decision making but in questioning those who today are able to dictate not only what science is used for, but even the priorities in research. Such an

awareness therefore has profound social and political implications -such an awareness would be a sure catalyst of social change.

In the context of a developing country like India the necessity of science communication is even more acute. Colonial education and culture was geared to producing a tribe of loyal clerks and subordinates, not a creative people equipped with a scientific consciousness. (It is therefore no surprise that as part of the nationalist awakening, there was a demand for more science education. Associations like the Indian Association for the Cultivation of Science and the Banga Vigyan Samithi were organized as part of this trend). Poverty, hunger, disease, illiteracy, feudal opression, divisions of caste, untouchability, sati, bride - burning, human sacrifice - such is the list of problems that we need to confront and for which purpose a scientific consciousness is an invaluable tool and an essential precondition.

5. IMPACT OF THE GAP OF SCIENCE :

But the presence of a communication gap between science and the people is very bad for science also.

Science has in the best periods of its growth - in the period of so-called scientific revolutions - been marked by a breakdown of barriers between scientists and craftsmen and workers and common people. Science has been enriched and spurred on to achievements by the active contribution and interests of the whole of society and its needs - not of scientists alone.

Besides 'The absence of popular understanding, interest and criticisms reinforces in the scientists the already dangerous tendency to mental isolation'. This does not as usually imagined take the form of the scientist as the other worldly person - the 'abstract - minded professor'. 'The isolation is of science, not of the scientist. Just as amongst people of a literary culture, there is almost an affectation of knowing nothing about science, there is a similar affectation in scientists to all other branches of science other than their own'.

The impact of increasing specialization has only served to further this trend. It is true that specialization is a necessary and important pre-condition for the rapid advance of science. However, vis a vis science communication the growth of specialization has imposed new obstacles that need to be overcome. While the development of a speciality of science communication and professional science communication is one essential response to this scenario, it is by itself an inadequate response. There is a necessity for all scientists to have

an overview of science and to be able to communicate their own work to a larger audience.

Other than in his own select field the scientist is just like any other man, with all the same attitudes and prejudices. His understanding of other sciences especially the social sciences remains coloured, by all the commonest prejudices and superstitions of the time. In the absence of a genuine background to his science, these social influences unconsciously enter into many a scientific theory.

Further working as he is in isolation he tends to lose grip of the total social relevance and impact of his work.

6. GROWING INTEREST IN POPULAR SCIENCE :

This breakdown of communication between scientists and the community is surprising. The presence on all sides of machinery and services which incorporate scientific principles, the common use of a lot of knowledge - from the calender to a weather forecast which incorporates millenia of scientific history - all inevitably force a consciousness of science different from that of previous periods. There are, other than professional scientists, millions of people who have some degree of interest in science. This interest ranges from the practical understanding of some limited field of science, such as that needed for a farmer or a amateur astronomer to a general interst in the wonders of science. For these sections there has grown up a large volume of literature, articles, magazines and books on popular science. However the impact of the large range of popular science available today in terms of creating a scientific temper-of communication of science-is surprisingly limited.

7. SCIENCE IN THE MEDIA :

The press now covers science more regularly than ever before but still accounts for only a very small percent of total news covered. Even such information as is covered is scrappy and fragmented and generally is purely sensational on the front pages and main slots and hopelessly obscure in the supplements and feature pages. Few have science editors who can sort out and pick out the relevant pieces and present it in a relevant way. Yet over time one does note a constant improvement in the quality of science coverage, especially in many popular science magazines at least.

Books on popular science are still largely inadequate and as in the case of the magazine tends to be fragmented and while publishing a great mass of details, somehow manage to leave out the method and spirit of science. The experience of the people's science

movement and of a number of other dedicated individuals and groups, though significant and dealt with later, do not still define the majority of such publications.

Despite considerable science coverage on AIR its impact has been limited. The impact of science coverage on television is of course much more powerful. Unfortunately science gets numerous slots, mostly in low-priority time and the presentations are often so didactic, that the viewer prefers to switch off most of the time.

Why does such a situation prevail — both in formal education and in 'Popular Science'. How is it that despite so much science communication and the role that science has in our everyday lives scientific consciousness lags so far behind? This is a question that science popularization and science communication must face.

One common justification of existing conditions is that so rapid is the development and multiplication of scientific knowledge that the time has gone past when any mind can profitably understand more than a small part of it. This myth, often fostered by specialization, hides the fact that though such is true of the whole range of accumulated facts, the numbers of concepts both new and old are limited. Given a well arranged and easy access to scientific knowledge, it should be perfectly possible for every educated and interested person to have a general picture of the whole of science sufficiently detailed for him to grasp the underlying concepts and its significance, and be able to appreciate a significant new development. Such access is at present not available to the vast majority of people, including scientists.

The whole 'Quantity' of science popularization is grossly inadequate. Only a small fraction of the media and popular publication is given to science and that too fragmented, sensational tit-bits. Most scientists themselves are reluctant to have anything to do with popular science. Governmental and institutional support for science popularization remains inadequate and tied up in red tape. The impact of science popularisation must also be set against the impact of popularization of unscientific beliefs and the unfavourable social mileu in which science popularization takes place. For every one good science programme on TV or good article in a magazine there are a number of unscientific pieces. Unless there is constant pressure to keep up the coverage of science themes, the scientific themes get swamped by the rest. Again, even the limited amount of science communication or popular science that goes on presents science as a miracullous or magical entity, something very distant from the life

of a common man. The language, the technical jargon and the mass of details all convince him that science is something beyond him.

A typical newsreel or film on a factory or on hospitals is likely to show a number of uniformed or white coated workers and doctors respectively, in ultraclean surroundings, operating or standing next to very complex - looking machines that have blinking lights and emit curious sounds, while the commentary stresses how by pressing a button so many thousands of so and so product are produced per minute or that rare disease is diagnosed all at one.

A common image is built up of the scientist as someone who works in laboratories and with complex equipment and does things that ordinary persons cannot comprehend. Due to such communication it appears to follow that science too is such an entity - quite distinct from the lives of ordinary people and understandable only to a chosen few. The common image of science does not credit for instance a fisherman with any scientific knowledge though he perhaps knows more practical astronomy and more about the seas, weather and behaviour of fishes than the average educated man.

The image of science built up is also that of a great tool made by scientists and used in factories and offices and laboratories to make a host of products and services (and profits) but the entire process by which these great edifices were built and the role of the labouring people in it is lost.

Finally nowhere does the method of science and its 'spirit' find place. The spirit of questioning, of proving in practice, of critical analysis and deduction, of faithfully and accurately observing, of classifying, of recognizing its collective nature and the humble role of the individual - none of it comes through at all.

9. THE DIRECTIONS & APPROACH :

The method of science, scientific consciousness, scientific temper, the scientific 'spirit' - these indeed should be the goals of science communication to the public.

To achieve these ends, science communiciators need to stress the collective or societal nature of science. They also need to stress its historicity - the fact that scientific knowledge and concepts and even the method of science as we know it today is the product of the collective endeavour of all society over millenia of history. Much of the foundations of all science were laid by working people in the pursuit of their livelihood.

Historicity & collective nature need not be shown separately, as separate subjects, but in the approach to each and every topic. It is desirable to attempt to approach any given topic using frames of references and starting points that are familiar to the target audience. This includes for example, explaining the science inherent in their everyday lives in the appliances they use, in the natural phenomena they encounter and in the fund of knowledge that they have acquired and which forms the cultural basis or 'philosophy' of their lives. Even myths and stories that their tradition has handed down, serve as starting points to which scientific concepts can be co-related.

The method and spirit of science can be effectively communicated only if science is treated as an integral whole and not as fragmented bits. Fragmentation between branches in natural sciences is one major hurdle. The greater hurdle is the almost complete divorce of natural and social sciences. Thus for example discussions of nutrition deficiency diseases name food stuffs, vitamin requirements, amounts to be taken but refrain from mentioning the social causes of such diseases. Such fragmentation only leads to further alienation of scientific knowledge from our daily lives.

Then again it is necessary to point out the actual process of development of scientific knowledge and its sharp limitations. To point out the limitations of scientific knowledge and its pitfalls, the lack of knowledge in certain fields and the controversies, also help to show the actual way in which science works. Unfortunately this is almost never done and scientific theories are often presented as facts. Scientific achievements are often painted in such rosy colours that once that public sees a pitfall or one of the promises turns sour it is the whole edifice that is questioned. Again it is in the process of development of science that we can see clearest how scientific temper militates against prejudice and how it itself is open to correction and the entry of new ideas.

Then, there is the question of language. Unfortunately most scientific information and a lot of good popular science is available only in English. Necessarily one needs a lot more work in regional languages to reach the vast majority of Indian people. This calls upon a whole new dimension of tasks - introducing into the languages an entire galaxy of new words, idioms and phrases that can convey new meanings-meanings that the language has so far never been called upon to express. Except in a few languages little work has been done and even here the translations are so incomprehensible and difficult that the task becomes even tougher.

Finally, there is the inherent problem that almost all methods of science communication have this common defect they are all passive. They are presentations of science that can be listened to or rejected by a public which is not itself actively involved in it, which has no part in them. As long as it is only accepting a set of statements, the public will find it difficult to differentiate between say claims to astrology or dowsing or any fanciful pseudo scientific theory and science.

'Science will never be popular unless all citizens at some part of their lives and many citizens throughout their lives play an active part in scientific research themselves..... but this is a problem as much of social as it is of scientific organization'.

10. CONCLUSION :

Given our understanding of the social functions of science, of the potentials of science, we can clearly not agree with the image of science that is communicated today. Science is a liberating force-both in its indirect effects through transforming industry and directly by widening all human minds and giving them a greater possibility of realizing, their human capacities. Once a more widespread understanding of the results of science its methods and its possibilities is reached, it is bound to have a far-reaching impact on social transformation. The people's science movement and its thrust in science communication, is indeed a response to this need and it is to its experience we now turn.

PART - II

AN OUTLINE OF PSM EXPERIENCE :

The people's science movement has, as one of its main goals, the popularization of science amongst all sections of the people. For the people's science movement, science is a liberating force and the creation of a scientific temper and awareness about science, a means of catalyzing social change.

In the form in which PSMs have arisen and grown in India there is perhaps no other equivalent movement elsewhere. But this is not to say that these were the first people to use science in this fashion. Over the last hundred years a number of individuals have actively to promote scientific understanding in the public. Such endeavours, associated with names like Huxley, Haldane and Bernal, were largely

individual scientists writing or lecturing about science for the benefit of the public, with a conscious aim that such awareness would promote social progress.

Organized movements for science popularization were fewer but we note that in pre-revolutionary Russia, two organizations 'Nauka' (Science) & Znanye Sila (knowledge is power) functioned as science clubs for educating workers and represented open forms of organizing people against the Czar at a time when all other forms were forced underground due to repression. After revolution, a number of socialist countries made tremendous strides forward in promoting popular science actively and in an organized manner. Many organizations like 'Urania' in GDR are typical examples of this.

Meanwhile in the 1930s in the Western world, especially in Britain, a group of dedicated scientists took up the study of inter -relationships between science and society and the social responsibility of scientists, notable amongst them being the social Relations of science Group.

Similarly in India many small organizations were formed, especially after independence for the popularization of science. Important to note amongst these were the Banga Bijnana Parishad founded by Satyendra Nath Bose, the Assam Science Society set up in 1953, the Bigyan Pracher Samiti (set up with JBS Haldane's active involvement) in Orissa, and the Sastra Sahitya Samithy in 1957 in Ottapalam in Kerala and then in 1962 in Calicut the Kerala Sastra Sahitya Parished was formed.

Before we take up the discussion of the growth of KSSP and the other PSM groups, we would like to state that the above background of past science popularization work both in India and in the world is insufficient and that there is a urgent need to compile and present this aspect of the history of science.

The KSSP was initially an organization only of science writers. But two more streams merged into it - one was the earlier formed Sastra Sahitya Samithy - a group of 'social reformers and activists who saw in science an useful ally in their struggle against the outmoded past'. The third stream was of Malayalee scientists working outside Kerala 'who were beginning to question the relevance of their scientific practice which had very little relation to the immediate and pressing needs of the common man'. By 1967, the KSSP had emerged as a well defined organization with a common perspective which had science popularization as one of its main objectives. In the following decade 1967-1977, this organization grew into a mass movement.

The seventies saw the emergence of a number of other science organizations -the Delhi Science Forum, the Lok Vidyan Sanghatana, the Marathi Vidyan Parishad the Karnataka Rajya Vigyana Parishad and the Hoshangabad Science Teaching Programme. In the early eighties, Ekalavya, Gujarat Vidyan Sabha, Tamil Nadu Science Forum, the Madhya Pradesh Vigyan Sabha were formed. Many of these organizations were inspired by the KSSP example but there were many differences in their organizational style and methods of science popularization. By the time of the Bharat Jan Vigyan Jatha (1987) there were organizations active in Kerala, Tamil Nadu, Pondicherry, Karanataka, Madhya Pradesh, Maharashtra, Delhi, West Bengal, Assam and to lesser degrees in U.P., Bihar, Orissa, Himachal Pradesh, Haryana and Meghalaya. However amongst these the organizations active in mass science popularization work were only in Kerala, Karnataka, Maharashtra, Madhya Pradesh and Pondicherry.

The Bharat Jan Vigyan Jatha was a significant milestone in science popularization work. Already in 1983 the dept. of science and technology had set up a national council for science and technology communication under the dept. of S&T which was actively supporting science popularization work. With active support both financial and organizational from the NCSTC, it become possible for all these various groups to come together and launch a major united science popularization campaign. As a result of this campaign, many organizations that were dormant, or confined to pockets inside a state, or largely confined to discussions, now spread out and took part in the jatha activities. In many states, especially like in Andhra Pradesh, new organizations for science popularization emerged. Much more important, especially from the view point of this paper's theme, the experiences in science communication, were to some extent brought together and shared by these groups and then disseminated all over India. Our following discussion of the approach and role of different media thus talks of PSM experience in science communication but it has to be kept in mind that it is largely KSSP experience or PSF experience of LVS experience or Ekalavya experience; and only recently can we talk of it, and that too with sharp limitiations as PSM experience.

SCIENCE PUBLICATION - THE WRITTEN WORD :

Most of the organizations in the fifties & sixties, laid almost exclusive emphasis on popular science writing.

Popular science writing, had two hurdles to overcome. One was to find persons knowledgable enough in science who could express it in a lucid way in the regional language. A considerable amount of effort in popular science movement in the fifties and sixties was directed to technical words in regional languages and the writing of glossaries and encyclopedias and translations. But this was not a job for a voluntary organization alone. In Kerala, collaboration with the State Institute of languages proved fruitful to achieve this end. (In Tamil Nadu in contrast, considerable effort has gone to this aspect for well over half a century quite independent of PSMs but as a part of the Dravidian movement's emphasis on Tamil). By the time most other PSMs had been formed most regional languages already had considerable science output in regional languages and it was no longer necessaryto lay exclusive emphasison this. Nevertheless problems in language - the choice of words; whether to write a technical term in the regional script as such, or to coin a new word for it; clarity of expression, especially where technical phrases are used, continue to pose problems. It is often necessary to ignore the word selected by language scholars and use a simpler direct substitute to promote communicability of the idea. For example should telescope, a relatively well known word, be written as such in the regional script or should a new descriptive word be coined for it as has been done in Hindi & Tamil by the purists. The problem is further compounded today by the fact that thanks to changes in school text-books such 'pure words' are also widely understood today and it is not easy to resolve which is clearer.

The second major problem that PSMs had to face was the organization of publication and sales. Almost all PSMs have entered magazine publication early. The KSSP in 1966 started their quarterly journal 'Sastragathy' that in 1974 become a monthly journal meant for its members and general public. 'Sastrakeralam', started in 1969 and 'Eureka' in 1970 served school students of 11 - 14 and 8 to 12 age groups respectively. The KRVP started its publication of 'Bal Vijyana' and Ekalavya started its publication of 'Chakmak' and the Pondichery & Tamil Nadu Science forums started its publication of 'Thulir' soon after they had started their mass science popularization work. Except for the KSSP publications the starting of the other magazines were helped to a large extent by financial grants. At least for the KSSP, Ekalavya, TNSF & PSF the magazine played a crucial part in their public image and helped to a large extent in the emergence of these organizations as mass organizations. The impact of all these magazines in the public was also positive and this

encouraged them to further expansion and a number of activities based around these magazines.

The experience of the youngest of these 'Thulir' is especially note worthy. Starting from a circulation of 5000 in November 1987 it rose to 30,000 in just one year (with a peak at 50,000). It served as an organizer for TNSF and PSF and gave the organizations a mass prestige and popular character. Despite the universal acclaim of both form and content, further expansion has been slowed down due to working capital and organizational constraints. Nevertheless one can confidently predict a further expansion in the near furture.

Popular science book publication both of general science and on social issues concerned with science have been far more widespread. While some published at least initially along with a publishing firm (like the first KSSP books, and all of PSF's books) many have published on their own. Again response to sales, especially for some books like 'Nature Science & Society', 'Essential Drugs & Bannable Drugs' etc. have been tremendous. The style and content of the books, the quality of production and relatively low price have contributed to such a response but it also brought out the latent demand for popular science books in the regional language.

The KSSP experience has been the most overwhelming. In terms of statistics -45,000 copies of the essential drugs' book are sold, some 1,00,000 copies of Nature Science & Society and another 40,000 copies of 'Nature - the endless textbook' have been sold. In just one year, 1988, four crore rupees worth of books all in Malayalam have been published and sold. The experience elsewhere, though nowhere near the same scale have been quite heartening also.

At this stage, only three generalizations about science publication work can be drawn,

a) The experience of all groups is that these publications - books or magazines largely sell as a result of voluntary effort. They seldom sell through commercial circuits and general book-shops in such quantitites. The sale of books and magazines is directly related to the width and nature of other PSM activities. The more active the local units of an organization, the more are the sales. Sales in KSSP is largely through book-selling squads who visit every office and house in the locality. Science books are largely being sold by PSMs as part of campaigns and as part of their other activity.

b) Most PSM groups, however keen on such work they may be, are severly restrained by lack of capital. The lack of infrastructure not so much to print as to keep stocks and accounts and sustain these campaigns, is also a major obstacle.

c) If these two above limitations (infrastructure & capital) are overcome, and well-written books are taken to the public, the response to these books is enthusiastic enough for us to consider that the public perceives them as significantly different from other science books available on the market. To a large extent most of these books view science integrally, relate to society and convey the spirit of science-not only its facts.

However these are only generalizations. There are numerous books that could have been written far better or sold more imaginatively. Despite so much work done, the PSM movement, in India as a whole, is only in its infancy in books & periodicals publication.

SCIENCE LECTURES - WITH & WITHOUT SLIDES - THE SPOKEN WORD

Public symposia, lectures, panel discussions and seminars have been an important form of activity of nearly all PSM groups. Mostly these are sporadic and the audience is made up mostly of members and sympathizers.

In 1972 and 1976, the KSSP organized two major campaigns of public lectures. In the latter campaign, 100 activists were trained, who in turn trained 1500 more as lecturers. A total of 12,000 classes were held and a million people are estimated to have listened to these lectures. Since then a number of lectures have been held in Kerala on topics like Nature Science & Society; Public Health; Resources of Kerala; Agriculture in Kerala; Astronomy; deforestation etc. and these lecture campaigns are almost an annual feature.

To our knowledge, no similar massive campaigns were attempted elsewhere except to a much smaller degree by LVS in Maharashtra. Of course, though not in such a fashion, public lectures were carried out by all groups. The use of posters and slides as visual aids during there lectures were also sporadically carried out.

In January 1986 and again in February 1987, the Pondicherry Science Forum carried out two public popular science lecture campaigns-on astronomy and on peace, covering more than 20,000 people & training more than 30 lecturers . These campaigns were marked by the production of a number of copies of slides and their distribution and use in what is called 'Slide-show-lectures'. Similarly LVS and Ekalavya had also conducted slide shows as part of their activities. The duplication and dissemination of ten slide-shows during the BJVJ and the great demand for these have ensured this form of lectures as a major form of science popularization.

Slide show lectures have the advantages that they attract audiences and make for easier understanding and retention. They make talking lesser and easier and require relatively low technology. The cost of slides when mass produced can be reduced to Rs.2/- per slide. If properly taken, using the same slides, the lecturer can alter the nature of his talk to suit the audience. And finally the lecturer himself gains confidence and inspiration and the feedback serves to motivate him. Most do not prefer a recorded cassette for the sound track as it removes the interaction with a lecturer and the ability to vary the lecture according to the audience.

Despite these advantages, due to many reasons this form is still far from optimally utilized. The lack of easy availability of cheap and efficient slide projectors remains the major reason for the under-utilization of the slides available. There are also limitations to the amount that can be conveyed through such lectures.

VIDEO :

Video is a potentially very useful method for science communication, now that TV sets are very widely available. However PSMs are still in their infancy in video production. There are however a number of very good science programmes on television that can be usefully copied and disseminated, even as PSMs develop their own infastructure in this field. Though availability of VCPs, good video films etc. are a big handicap, these can be used for science communication to small groups especially when used along with, preceeding & following discussions.

TOYS, SCIENCE KITS :

Low cost science toys and science kits are another popular means of science communication as proved in the Bharat Jan Vigyan Jatha. The Lok Vidyan Sanghatana, Ekalavya & KRVP had been using it already in their programmes. The main advantage of such methods

is that audience participation, especially in small groups is possible. Its success also depends much on proper training of the resource persons.

POSTERS :

These have been used with good effect. Usually they are used to supplement other programmes. Along with properly trained resource persons for explanation and discussions and also dependent on the quality of poster design these have proved useful.

SCIENCE MELAS, SCIENCE FESTIVALS & SCIENCE EXHIBITIONS :

Very few PSM organizations are associated with this except some work by the Lok Vidyan Sanghatana. Usually such festivals are Government or institution organized. (The children's science festivals and Bal melas are dealt with later)

SCIENCE MUSEUMS :

Largely organized by the National Council of Science Museums, they provide valuable contribution to science communication work. Their reach however is limited.

SCIENCE JATHA S - 'SCIENCE THROUGH ART' PROGRAMMES :

The first Sastra Kala Jatha was the KSSP'S Science jatha of 1977 where a few musical slogans evolved. Then later, inspired by the Samudaya's experiences with folk art, performing arts were introduced into the science Jatha. The content and form of the 'Kala Jatha' were collective creations.

The success of this approach to science communication was immediately evident and the Sastra Kala Jatha became a regular annual feature. However only a very limited number of ideas can be conveyed in such short performances. And it has more impact if it is part of a series of other science communication activities. It also provides tremendous emotional support and popular attraction for the organization and was a rallying point for its year long campaigns, especially of science books sales.

The 'Kala Jatha' was taken out to various states Karnataka, Madhya Pradesh, Uttar Pradesh, Delhi, Gujarat and Tamil Nadu in the next few years and served as a powerful introduction to the Kerala Shastra Sahitya Parishad and to such science popularization work.

In October - November 1987, the Bharat Jan Vigyan Jatha was organised which saw the extensive use of this form all over India. The role that this played in this jatha was different. In most places this Jatha only served as an attractive introduction to the existence of the people's science movement and to its possibilities. There were active discussions everywhere as to the science content of these plays and about the science movement's perception of science. The benefit of such discussions and subsequent follow up depended largely on the already existing activities and activists present in those centres. Already, other then the KSSP, many groups had emerged all over India who were using folk art forms and street theatre for communicating social themes. The BJVJ has encourged many more groups and many more centres to take up this form of communication.

THE CONTENT & ORGANIZATION

While we have given a brief account of the various methods and media used in science popularization by PSMs, we have been able to say little about the content of such communication. Most PSM work is done as part of a conscious attempt to break with existing styles of science communication and existing stereotypes of what science is. The people's science movement's rise is itself a part of a dissatisfaction with the present role of science and science communication. Their publication and software developed reflect this desire but there is still a lot more work that needs to be done to improve the quality of their communication-both the form and in content.

The strength of PSMs in science communication however lies in that they are going out to the various schools, and to villages and to various other sections of the public. This requires a good deal of motivation, which is the main strength of most of these organizations. Given such motivation and this continued interaction with people the outlook for further improvement and further expansion of their science communication work is very bright.

The style of science popularization adopted by most PSM groups now, involves training a number of volunteers who go to the public. Involvement of such large numbers of volunteers in this work enriches the programme and builds a more reliable base to ensure that science popularization work continues. However both due to financial constraints and more important, that of 'leave', (as most such volunteers are in urban middle class occupation), training

programmes are too short and inadequate. More elaborate training camps to ensure that the resource persons themselves have adequately understood the subject and the methods is essential to strengthen this aspect of PSM work.

OTHER POSSIBILITIES :

But the methods discussed above are not the only media or channels available for science communication. Nor in that sense can a complete list of methods be ever drawn up. There are a number of other forms of science communication that are rapidly emerging.

PUPPETRY :

Puppetry for example is one such form. A number of PSM groups are now working with puppets and they have even been part of 'Balotsav Jathas'. Their attraction and potential for science communication, especially to children is immense.

CAMPS & FESTIVALS :

Then again 'Camps' and workshops can be another interesting avenue. Indeed far more meaningful and comprehensive science communication can be done in a camp than in any other way available now. Thus nature study camps, environmental camps, living with science camps and so many other camps are now being talked about. Of these undoubtedly the most exciting form is the childrens' festivals. They were first held in Trichur in 1987 and then in Bombay and Pondicherry in 1988, and in Orissa in 1989. In the Pondicherry camp for instance there were 688 participants, camping for one entire week. Daily almost 10 aspects of science were tought by resource persons and one full day was given to environmental learning. All the 240 guest children were hosted in the homes of 120 local children and the deep emotional attachments that developed could be seen in the farewell ceremony. Both in the preparation and in the conduct of the festival many people developed better understanding of science than they had hitherto gained by other forms.

RURAL TECHNOLOGIES :

Science communication need not also be seen as restricted to purely 'Science Communication' activities. The introduction and modernization of technologies appropriate for weaker sections and of our rural scene has been used by many groups as an entry point

to promote a scientific temper. The smokeless chulha campaigns of the KSSP and the Delhi Science Forum's work in rural technologies are two such instances that we are aware of.

AGITATIONS :

Mobilizing people for agitation and direct demands related to science have also resulted in 'Science Communication', perhaps even more effectively than by other means. Thus campaigns against pollution as in Mavoor in Kerala, against deforestation as in Silent valley or Chipko movement all have made people more conscious of the questions of science and technology involved. If led by persons, committed to meaningful science popularization there are great opportunities to increase the scientific awareness in the community, in the course of such campaigns.

LITERACY :

Mobilizing people for literacy is only recently entering the agenda of people's science movements. Except for Rajasthan, where the PSM associated nodal organization is primarily a literacy organization, no other group has entered literacy in a significant way. The KSSP has in February 1989, initiated a massive campaign in literacy in Ernakulam district. The creation of literacy is a primary step and pre-condition for scientific awareness. The linking of the two campaings into one, offers new possibilities of introducing scientific awareness to millions of illiterate persons all over the country.

OTHER GROUPS :

Finally we note that there are many individuals and groups outside PSM, who are doing excellent work, especially in the field of health and environment.This paper concenterates on the PSM experience as the context is that of the second All India People's Science Congress and it is important to outline our own experience. We do not in any way wish to ignore the importance of such contributions or lessen the necessity of persons working in PSMs to learn from them.

More important, the people's science movement needs remember, that the impact of PSM in the overall arena of science communication is still marginal except in Kerala. There is a need not only to expand but also to intervene wherever possible so as to ensure that a more meaningful communication of science take place and that

a better understanding of science amongst the communicators results.

AUTHOR'S NOTE :

Many of the ideas and concepts in this paper (Part I) were taken from J.D.BERNAL'S works. The KSSP experience is largely taken from 'Science for Social Revolution' - Experience of the KSSP' presented in the first people's science congress held in Cannanore. However many changes have been made and any views expressed, expecially mistakes should not be attributed to the sources.

This article was presented by the Pondicherry Science Forum (PSF) as the Theme Paper on science communication at the second All India People's Science Congress held in Calcutta. The PSF has won wide recognition in science popularization work especially for its slide-show lecture campaigns, for the popular children's Tamil science monthly THULIR as its producers along with the Tamilnadu Science Forum and for hosting the very successful All India Children's Science Festival in 1988.

RELIGION, SUPERSTITIONS & PSM'S

D.Raghunandan

It is a commonplace and widespread notion, however unstated or implicit, that a scientific temper or scientific attitudes and religions /traditional beliefs are by definition mutually contradictory and in compatiable. Religious beliefs are thus seen, per se, as a major impediment to the development of scientific temper; by extension, traditional beliefs and practices, closely interwoven with religion in most premodern societies and especially in India, are similarly regarded.

This notion has several implications both at a conceptual level and at the level of practice by development planners, PSM (Popular Science Movement) groups and others engaged in the promotion of scientific temper. Development planners frequently attribute the lack of success of development strategies to resistance by local communities "due to traditional beliefs and superstitions". PSM groups, rationalists etc. may also regard a frontal attack on religious beliefs as a **sine qua non** for the advancement of scientific temper.

It is necessary, however, to more clearly delineate the terms of this discourse. A much closer examination of the issues involved is essential. What exactly is meant by "religious or traditional beliefs"? What is the relationship between these and the other belief systems prevalent in society, and between them and structural / processual aspects of social reality? What should be the response of PSM groups to a whole complex of ideas and beliefs subsumed under the rubric religious beliefs? These questions are important not only for tactical reasons but also for theoretical ones: It is necessary to scientifically address these issue and, in a sociology of knowledge, understand the nature of socialised cognition and the relationship between beliefs and the social structure.

At the outset, it is clearly possible and necessary to distinguish between religious faith, certain religious practices such as ritual observances, prayers, festivals etc., and those traditional beliefs (with or without explicit religious sanction) which are revealed by, and directly affect, practical decision making in everyday life.

Religious faith confessedly operates in a totally exclusive paradigm inaccessible to scientific knowledge. Indeed agnosticism is the view that "nothing is known, or is likely to be known, of the existence of God or of anything beyond material phenomena". Thus

all attempts to disprove, for instance, the material existence of a god can simply be dismissed with the argument that god is a being of such "materiality" as cannot be addressed by the senses or by science. Similarly, the failure of a "miraculous performance" under scientific scrutiny can always be ascribed to the disturbing presence of non-believers. In the ultimate analysis, such faith is simply that-an article of faith requiring no other materials, rational scientific invalidation. Such religious Faith-beliefs are in the popperian usage "non falsifiable". In this sense, it may not be possible to directly "overcome" such religious faith with scientific reasoning alone.

The demonstration of trickery in "miracles" would have other effects and benefits, and these would be discussed some what later. For the present, let us shift attention, at a more general level, from faith to those traditional/religious kinds of beliefs which are generally felt to be far more problematic since they would appear to more directly affect practical behaviour and render everyday life irrational.

Traditional knowledge and beliefs.

Tribal, pastoral and agrarian communities, culturally incorporate a corpus of beliefs in gods and spirits representing various natural forces and elements: these beliefs and various rituals expressing them are known to play a significant role in practices relating to agriculture, animal husbandry, hunting and gathering etc. It is generally accepted that such a deification of natural forces is an expression of the incompleteness of the communities' comprehension of these forces and their ability to harness them. In any case, it is equally appreciated that these communities also display a wide - ranging practical knowledge of the diverse factors and elements which determine the results of these productive activities. This traditional empirical knowledge is applied in rational decision - making in these spheres despite religious beliefs in gods and spirits and their powers. Belief in the efficacy of religious invocation does not deny, nor oppose, practical measures to achieve the desired objective. These represent different orders of belief, occupying, in a sense, different cognitive spaces. Clearly, then the two sets of beliefs are of different orders or types and occupy different cognitive spaces as compared to knowledge of practical, everyday reality which is fully rational within the framework of existing knowledge in these communities.

We should note that whether the traditional beliefs and practices are to be consideired scientific or not is a some what seperate question. The point being made here is that the essentially rational

framework within which traditional knowledge -systems and practices (especially those related to production) are evolved cannot be called into question merely because they are also associated culturally with sets of religious beliefs. The scientificity or otherwise of traditional knowledge may be assessed from the fact that whereas this knowledge may be empirically accurate and valid in the micro contexts within which this knowledge is applied by members of the community, it does not constitute a set of universally valid theories and laws which could explain these are related phenomena and processes in any context. It is in this sense that the term scientific may not be accurately used to describe traditional knowledge systems.

Traditional knowledge systems may also not be scientific in another way, such as in those cases where even the existing empirical knowledge is incorrect and founded on erroneous beliefs, thereby leading to faulty or even harmful practices. For instance, the belief is widespread in rural areas especially among the Hindu population that the mother's "first milk" or colostrum is harmful and even may be deadly to the new born infant. As such infants are never fed colostrum and are denied its vital nutritional and immunisational properties. While this belief or notion may have originally been based perhaps, simply on different physical appearance, and may also have several quasireligious notions associated with it, neither factor is exclusively causing, or enforcing, the injunction. Indeed, a large body of field research indicates that the persistence of this belief owes more to the sheer inertial weight of habitual practice in the absence of knowledge and experience to the contrary. Also it is not possible to draw any sort of linear relationship between such lack of knowledge and primitivity "backwardness" or "traditionalism": many tribal communities in India e.g., the gonds of Bastar, widely regarded as more "backward" than peasant communities, always feed colosturm to the infants and in fact believe that the infant would die without it.

Everyday Practice and Religious Beliefs

To return to the main thrust of the argument, traditional knowledge systems with accompanying religious beliefs may not be scientific in the manner noted abote, but it is essential that we probe the cognitive complexities involved and isolate the actual practical effect they have on every day decision-making. Clearly, in terms of production and related activities the historical development of

techniques, processes and knowledge was achieved through a process of experiment, testing and innovation, guided by the experiential accumulation of practical knowledge regarding the outcome of different actions rather than through a literal actualization of religious beliefs. This is equally true of all human societies howsoever religious they are thought to be.

The ancient potter discovered the properties of clay and its behaviour when fired at different temperatures. The blacksmith discovered metallic ores, processes of smelting and heat treatment; farming practices of ploughing, sowing and harvesting were similarly worked out. At the same time, the sun gods, wind gods, fire gods etc. were also worshipped and their powers invoked to bless and support these activities. Surely, beliefs in these powers did not impede development; nor was it actually ever believed that invocation of the rain god could be a substitute for the construction and utilization of irrigation systems.

It is in this significant sense that one can speak of different types or orders of belief, or of different cognitive spaces occupied by them. It needs to be underlined that this applies not only to ancient, "primitive" or "backward" communities, to tribal or rural agrarian ones but also to the general lay population in urban and metropolitan centres in both advanced and developing countries.

Consider, for instance, a student visiting a temple to seek blessings of the deity for success in examinations. He would nevertheless take practical steps (study) to prepare for them, and certainly does not believe that the former is alone capable of ensuring his passing. In other words, this religiously-guided action is taken so as to supplement or reinforce rational, practical efforts and does not imply lack of acceptance of the rationality of the latter.

Let us examine another case. Workers in industrial undertakings in Bangalore, and in many other parts of the country, annually celebrate Ayudha Pooja (with different nomenclature for the occasion in other parts of the country), an ancient ceremoney conducted to propitiate Vishwakarma, the artisan of the heavens. On this day, workers attend the factories but do not engage in production; they thoroughly clean their tools, machinery and equipment as well as apply chandan, tika etc and put garlands on them. Does this observance, or belief in the protective powers of Vishwakarma, imply that the machine operators are unaware of the working principles of their equipments? Or detract in any way from their skill? Or does it merely express, analogous to the ancient worship of the elements,

the fundamental insecurity of the artisanal and working people, the fear that without their tools and skills they would be left only with their chains?

It is also interesting that in some public sector units in Bangalore, the workers also utilise this day, during which senior managers usually walk around the factory, to put up cartoons, lampoons, posters, etc. highlighting their demands, their perceptions of management. As protagonists of a scientific temper, is it necessary for PSM groups, or for that matter trade unions, to launch a campaign against this belief and ritualized practice? Or would they avoid doing so only for tactical reasons? Are there any sound theoretical reasons as to why they should not, which could be applied in diverse similar circumstances?

Historical, anthropoligical and sociological studies both in India and elsewhere provide sufficient grounds to posit the view that such religious beliefs which have bearing on practical action or play the role of practical knowledge-systems do so in the face of a paucity or vacuum of alternatives in the latter, and constantly undergo modification in the face of practical experience and changing social reality.

A case in point is beliefs and practices related to ill-health and disease. The most common and perhaps most propitiated goddess, especially in South India, is Mariamma (or her equivalent), the goddess of the pox. Yet this belief did not prevent the dramatic success of the small-pox vaccination programme even while people continue even today to propitiate her as protection against measles and chicken-pox, once again showing that while such religious beliefs may not be completely superceded or displaced, they may not actually impede rational decision-making since they are beliefs of a different order.

Numerous village studies have shown that while people today automatically resort to the PHC or other modern/allopathic practitioners, they continue to resort to traditional healers for such ailments for which treatment is either not available or inaccessible otherwise, such as for snakebites, epilepsy, mental and sexual disorders. At the great Tirupati temple, a large proportion of devotees seek divine intervention in health-related matters through the centuries-old tradition of propitiating the deity with silver stampings of the affected parts or organs of the body. One sees therefore, that the persistence of such religious beliefs or practices is largely due to continuing anxiety related to health and disease given an absence or

weakness in the modern health-care system and not simply due to "backwardness" or superstition.

Is India uniquely Religious?

It must be emphasised that this proposition is not peculiar to India but, in fact, stems from the general relationship between socialized knowledge and social-structural factors. This is well illustrated by a historical study in medieval England ("Religion and the decline of magic" by Keith Thomas). Examination of church records showed that a large proportion of worshippers sought performance of rituals to tackle ailments and diseases. The study showed that whereas theological debates internal to the church, particularly protestant arguments against magico-religious practicies, had some impact, that sharp decline in the number of such cases in the late 18th century in fact occured due to general improvement in public health caused by the variety of sanitation, medical etc. programmes. Clearly, the availability and direct experience of efficacious alternativies rapidly displaces religious notions of causalities and therefore of problem-solving.

Despite this mass of evidence, we are, in India, still labouring under the burden of having to wage a generalized war against religious or traditional beliefs at the level of ideas since, it is believed, unless this is done, progress cannot be achieved or the scientific temper advanced. Much of the (dis)credit for this notion must go to that great sociologist, Max Weber, who characterised the Indian belief-system and cognitive-structure as "other-wordly", oriented not to practical actions in this world but to benefits in the other. He was to advance this as the premier reason for the backwardness of India, despite its comparable position in the early medieval period in relation to the West, especiallyEnglandwhich, in possession of "the Protestant ethic" (which stressed "this-worldly" virtues of hard work and parsimony) was able to develop capitalism and therefore a modern, rational structure of both society and its beliefs.

The ghost of Max Weber today haunts India more than its other worldliness does. Developmental planners, intellectuals and many social scientists continue to argue, as indeed did many architects of independent India, that the traditional and religious beliefs of our people are among the biggest obstacles to progress, and to the scientific tempter which could be its springboard.

This paper will argue, to the contrary, that whereas religion as an institutionalized social force - and the primarily social cognitive

structures entailed - is quite another matter to be dealt with in an altogether different manner, "religious" or traditional beliefs relating to everyday practical action are not among the major impediments to societal development, progress or the scientific temper. Further, to the extent, that (and in those specific cases where) they are manifestly opposed to scientific concepts, they cannot be combated at the level of ideas alone but will yield only to the practical diffussion of concrete, accessible alternatives in society at large and to broad social movements working towards such possibilities, which would result in the generation and sustenance of socialized scientific cognition and attitudes.

Can ideas be combated by ideas alone?

It is a crucial if quite familiar question in the social sciences in generally, and in the sociology of knowledge in particular, as to whether systems of ideas or beliefs respond to challenges at the ideational level alone or to broader social changes including, and which bring in their wake, systemic changes in ideas. This is not to argue that ideational challenges should not be posed or that this would have no effect whatsoever but rather to remind ourselves that these ideational changes, not only as accompaniments to but as integral components of systemic changes in experimental everyday reality and its material conditions, take place essentially as part of broader changes at the social level. Fundamental alterations in cognitive structures cannot occur without structural changes, or the immanent potentialities of them, in material conditions and social relations.

To argue otherwise is to depart from the very materiality which is held up as the foundation of science, natural or social. Practical attempts to actualize such theories have, not surprisingly, been singularly unsuccessful. One has only to compare the atheistic, rationalist foundations of the Dravida movement with the present religiously-suffused atmosphere in Tamil Nadu to appreciate the point. Not only have the political inheritors of the DK long abandoned atheistic rhetoric in both statecraft and cinema in favour of god-fearing moralism and intensified temple construction/maintenance/support, the very heroes of yesterday's rationalism are today's demi-gods. Clearly, social and political dynamics have had much the greater impact and staying power than the philosophical or ideational rhetoric of its rationalist ideologues or the movement spear-headed by them which left unchallenged the structural foundations of Tamil society.

The above discussion may be elaborated considerably and put in a fully articulated theoretical framework of a sociology of knowledge. However, given the scope of this brief/paper, it has not been possible to do so here. In any case, the argument has, perhaps, been sufficiently established or at least adequately put forward, that in considering traditional beliefs and practices, especially those with religious support or overtones, and their relationship to the scientific method or rational outlook, care must be exercised to examine the nature of these beliefs in specific, their relationship to and implications for practical everyday action, the "rationality" of these beliefs within the existing body of empirical knowledge and most importantly, the relationship between these state of beliefs and the social realities which circumscribe and shape these beliefs. In brief even if certain traditional beliefs and practices are known to be incorrect this is not sufficient to lead to the conclusion that they necessarily and actively prevent the acquisition of new knowledge or to argue that they are the active or main impediments to the growth of rational attitudes.

It is worth reiterating that beliefs may be of different orders or types. Sherlock Holmes, demonstrating this argument (ad absurdum perhaps) shocked his friend Watson by once admitting that he neither knew, or cared to know, that it was indeed the earth that went around the sun rather than the other way about! Holmes asserted to the aghast Watson that such knowledge was of no practical use to him in his work, which he could continue to perform scientifically without it, and that he preferred to keep his mind uncluttered by such useless information!

Religion as social force

All this is not to argue that religion, as such, is a docile cognitive force which will disappear of itself when confronted with advancement of material conditions, the technological mastery over nature and the accompanying spread of scientific knowledge. While I have definitely argued that certain types of traditional or religious beliefs would indeed be superceded by more rational ones, I have been careful to assert that religion is not merely a set of beliefs or practices but is a much larger social entity, a social force.

One can hardly aver otherwise in the face of continuing communal conflagration in Northern Ireland and apartheid in South Africa, born-again revivalism in the USA or, for that matter, revivalism in Poland, and societies with considerably advanced

material conditions and generalisied scientific awareness as compared, say, to India. These movements and the beliefs they embody have clearly little to do with the kind of traditional beliefs we have been discussing and which may be totally absent in this socieities. Clearly, no linear relationship can be posited between religion as a whole and technological advancement or awareness of scientific facts.

Such aspects of religion as fundamentalism, communalism, etc. are part of, and should be understood as, larger social forces which owe little to any particular corpus of such beliefs and practices as we have been discussing. These issues are to be tackled in the much larger social domain rather than in the more restricted spheres in which a rationalist focus on battling superstitions or outmoded beliefs alone is capable of covering. The ideational battle such as that conducted against "unscientific" notions, may have little impact in the larger domain. Even the valiant struggle against communal historiography while being an extremely important and crucial component of the overall struggle for social rationality clearly cannot be itself, or even directly, reverse a board social tendency towards communalisation let loose by larger social and political forces and processes in which at one level, it seems to scarcely matter whether the Babri Masjid, or the Ram Janma Bhoomi was actually built first. All these are akin to skirmishes on the fringes: the main battle may not even have been joined, let alone won.

For the battle to be truly joined, the skirmishes at the ideational level must also be part of coordinated campaigns at the societal level. It is only when an integrated campaign is waged at all levels, when it emerges as a social force representing, and seeking to actualize, a new social reality, that fundamental changes in ideas, beliefs and practices would become a possibility.

The role of these larger social forces, state policies with regard to religious institutions, the sexes etc. dealt with in other papers in this seminar are of greater practical import and significance than any corpus of traditional beliefs in determining societal processes, events and, therefore, socialized cognition. PSM groups and others seeking to advance the scientific temper or rational outlook must, of necessity, address these issue while also advancing scientific awareness and seeking to dispel incorrect beliefs. It would follow that not developing a scientific view of both the larger social forces and of traditional beliefs, and charting a course on that basis, may then work out to be a greater impediment to the scientific temper than

are the (currently and temporarily) erroneous nations of "the common person".

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EDUCATION WITHIN THE FRAMEWORK OF PEOPLE'S SCIENCE MOVEMENT

BY EKALAVYA

An understanding of the development process in post-independent India inevitably requires a reference to the legacy left behind by the colonisers. One such legacy is the colonising of the mind. A necessary adjunct of economic and political colonialism, it continues to play an important role in contemporary Indian Society. Thus, Marx's famous observation about the dual nature of colonialism has found a curious echo in the body-politic of independent India. In fact it is widely accepted that the economic and political domination of the colonial power was enabled precisely because of its superiority in both technological capacity and in the realm of 'progressive' ideas - an euphemism for rationality and modern science. As such, colonialism played a 'positive' role in pinpointing the inherent weaknesses of traditional Indian society.

Such a reading of colonialism is crucially influenced not merely by the processes of State intervention in independent India, but the response of dissenting intellectuals as well. Heavy industrialisation was the means by which Nehruvian economics sought to transform a 'backward' society. Subsumed in this economics has been the naiva hope that increased productivity would automatically result in an equitable distribution of the produce and profits. The crucial pillar on which this whole thesis rested was a massive input of modern science and techonlogy (S & T). Essentially this hope and thesis continues to dominate the Indian body - politic. In fact it has been pursued much more vigorously in recent years, even though the resultant capitalist growth, mediated by neo- colonialist multinational intervention is there for all to see.

The 'progressive' aspect of the colonising of the mind found an expression in the Nehruvian thesis of 'scientific temper', a term least understood, but much published. In effect, it has remained a mere rhetoric empty of content. The proof of the emptiness of this rhetoric is evident from the strain on the science-society interface resulting from the Bhopal gas disaster. Here is a flaring example that has gone abegging in defining the links between toxicology and medication, environmental hazards and citizens' rights and most important, scientific evidence and legal issues. In the absence of even a rudimentary 'scientific temper' within institutionalised science in the

country, the mass murder of over 3,000 persons and long term health effects on over two lakhs persons have been priced at a few hundred crores, with no liability. Subsumed in the happiness expressed within official circles regarding the settlement is the fact that the State had taken it upon itself to represent the victims in a matter involving complex S & T issues without any clue as to how to weave the scientific evidence into a legal sledge hammer. With such a pathetically weak legal case, unsupported by even an epidemiological survey, not to speak of research findings, it is only appropriate that happiness should be expressed officially at having extracted a few morsels.

In a sense, none of this ought to be surprising. A developmental pattern motivated by profit and capital, with the concomitant of a 'neutral' and 'value free' science, is essentially inimical to a critical mode of thinking that may question the values and policies of such a framework. Just as a profit motivated production process demands a disciplined, controlled and, hence, a servile workforce, so does it demand and ensure an uncritical mass of population that serves as a market, willing or unwilling, for the goodies. After all, where will the profits come from?

The production process however does require a fairly large human force, but they need only have skills of a technical and managerial kind; an overcritical attitude would in fact be a threat to the whole process, and hence to the body-politic. Little wonder then that the basic educational infrastructure has remained relatively unchanged in approaches to content, method and pedagogy from colonial times. One may, therefore, grossly conclude that whereas the educational infrastructure during the colonial times was shaped essentially to service processes relating to the appropriation of the colony's natural wealth; in free India, the emphasis has broadly shifted to servicing the appropriation of surpluses. Such a conclusion is indicative of the fact that the education infrastructure in a colonial and a capitalist system have a common residue; only the beneficiaries are, respectively, the colonisers, or a small segment of fellow countrymen and foreigners mediating via multinationals.

This then is the basis of the disjunction that has gradually emerged in the country, between the masses in general-people-and the miniscule rest. Media and educational onslaughts strive to make people accept that all this is 'progress' and 'development', and at the heart of such progress and development is the particular use of science and technology.

The role of a People's Science Movement (PSM) is therefore naturally defined within this framework as not merely that of communicating and simplifying science (though that is essential) but also questioning each aspect of such progress and development, in particular the S & T issues involved, and intervening wherever necessary with the active participation of the so called ordinary men and women. That is what spreading 'scientific temper' ought to mean.

ASSUMPTIONS FOR CRITICAL THINKING :

Having indicated a role for the PSM, the immediate question that arises concerns the methodology of action, against the backdrop of economic and political conditions outlined. A related question often asked in this regard in many different ways may be summarised, in the context of education, in the following manner:

'Given that the educational process is actually determined by the overriding political process, what then is the point of advocating any alternative within the educational framework? The alternative must be sought for in the body - politic itself. The stock phrase is that education is at best a 'post-revolutionary' activity. The question has also arisen specifically in the context of PSM - science for social revolution or social revolution for science?

The relevance of the question can hardly be denied, and it must be admitted that a complete answer to the question is perhaps impossible on purely theoretical grounds and it is only through the combination of theory and practice that answers can be explored. However, it does seem necessary to indicate an approach in furthering the debate on this question. Such an approach is not being suggested merely for academic purposes. Instead, the approach is itself indicative of the lines of action PSM could follow. Also, this question continues to create a nagging unease to practicing groups and hence, needs to be opened up for wider debate. Instead of inventing a fresh argument, in what follows, we shall briefly outline some aspects of Gramsci's ideas that seem relevant in the context.

The particular idea that seems to have the power to crystallise and unify various experimential observations is that of 'hegemony' a concept central to Gramsci's analysis of a stratified society. The notion of hegemony is most familiar in political history and international affairs where it refers to situations in which one nation exercises political, cultural or economic influcence over others. But Gramsci extended its reference to apply to relationships between groups, especially social classes. Hence, one social class can be

thought of as exercising hegemony over other 'subaltern' classes. For example, in a capitalist society, the upper classes can be said to be hegemonic in relation to the workers, peasants, tribals, et cetera. In this formulation, hegemonic direction is by moral and intellectual persuation rather than by the police, the military, or the coercive power of the law: rule by intellectual and moral hegemony is the form of power which gives stability and founds power on wide-ranging consent and acquiescene. For this to be so, every relationship of hegemony is necessarily a pedagogical relationship. Control of the subaltern classes is much more subtly exercised than is often supposed: it operates persuasively rather than coercively through cultural institutions, religious organisations, labour unions and other worker associations, schools and the press. Or, as Raymond Williams puts it, "..so totally do the complex forces of hegemoney saturate the whole process of living that the pressures and limits of what can ultimately be seen as a specific economic, political and cultural system seem to most of us the pressures and limits of simple experience and common sense. That is, we are persuaded that maintenance of the status quo could not but be in our own best interests".

What then would constitute a counter-hegemonic action? By counter-hegemonic is implied seeking alternatives to the status quo in areas such as science and technology, pedagogy, and culture. If one goes along with Gramsci's ideas, the assumption is that the ordinary people must learn that mental and related skills of the dominant ruling class. Hence it becomes clear that the counter-hegemonic task is one of education, in the broadest sense of the word. It is imperative therefore, to include some general principles to the specific nature of such education. This is particularly so because of the lack of clarity normally faced by PSM groups in grasping the tension between the dominant culture and education and the so called people's culture and education. To quote Gramsci, "..it must first be shown that all men are 'philosophers' or 'scientists' by defining the limits and characteristcs of the 'spontaneous philosophy' of 'spontaneous science' which is proper to everybody. This philosophy is contained in 1) language itself which is a totality of determined notions and concepts and not just words grammatically devoid of content; 2) 'common sense' and 'good sense', 3) popular religion and, therefore, also in the entire system of beliefs, superstitions, opinion, ways of seeing things and acting which are collectively bundled together in the name of folklore".

This formulation, akin to Piaget's psychology, amounts to saying that untutored intelligence frequently manifests itself in conception which are somewhat primitive (pre-operational) with reference to refined scientific and social modes of thought. 'Common sense' is a blend of 'good sense' and folklorist superstition. A positive people's action would therefore be concerned with the development of 'good sense', a state of mind in which common sense is exalted in its superstition and folklore and given a coherent unity through exposure to philosopher's philosophy, and scientists science, with the assumption that every man or woman, is a man or woman of science.

Hence, we have the inevitable conclusion that the practice of counter-hegemony is the practice of such pedagogy that derives knowledge, science, history et cetera in the classroom or outside, from popular folklore and commonsense. In this way the development of the component of good sense would not be a dominant, substitutive and exploitative enterprises, ridiculing, demanding and stigmatising the common sense of the people, but an additive component, which while preserving the common sense, sharpens it to make it equal to, or more than that of the ruling dominant class.

IMPLICATIONS FOR SCIENCE EDUCATION:

From the general, we now come to specifics, in order to formulate concrete action points within the PSM framework. In particular, an attempt shall be made to analyse the implications for science education.

The school structure is an obvious focal point for initiating processes of critical thinking. However, the hope that the schools of independent India, unfettered by colonial considerations, would exhibit a radical departure in approaches to content, method and pedagogy is yet to materialise. Why is it so? In particular, why has the science curriculum remained so stagnant.

It has often been felt, and assumed, that objective observation and analytic abstraction inherent in the method of science provides a liberating potential to develop deep social insights. It is remarkable that John Dewey should have such commonality of views with Gramsci when he asserts that "..whatever natural science may be for the specialist, for educational purposes it is knowledge of the conditions of human action", and "..the functions which science has to perform in the curriculum is: emancipation from local and temporary incidents of experience and the opening of intellectual

vistas unobscured by the accidents of personal habit and predilection''.

Despite these assertions, the curriculum has not really responded to such vision. What emerged then and has continued to provide the basic framework for school education is a model of 'Pure' abstract science, in consonance with the demands of logical coherence as viewed by professional practitioners of the discipline, making Dewey lament that "..aloof from the practical needs of the mass of men, advocates of scientific education put themselves at a strategic disadvantage".

An interesting account of changes that took place in the British educational system at a time when the capitalist path had truly been laid in that country (nineteenth century) is of extreme relevance here on two counts. Firstly, it is situated in a timeframe when the political transformation in Britain was somewhat similar to what is happening in India now - a transformation from a feudal to a capitalist economy. Secondly, it lays bare the origins of the cumulative thinking that has shaped the notion of school curriculum in science all over, including India. Two major alternative conceptions were available then: the 'science of the common things', and 'pure laboratory science'. The former was initiated by an influential clergyman, Reverend Dawes, with the aim of instilling self - confidence and integrity of thought amoungst the children of the poor, in an attempt to ultimately improve their moral and religious condition. the curriculum was consciously designed within the cultural context of the laboring classes and "..was no crumb of upper class education charitably dispensed". Prominence was given to the applied sciences such as mechanics and agricultural chemistry to provide familiar experiences for the exercise of reason, speculation and imagination. The success of the programme and its imminent expansion to all elementary schools was viewed as a major threat to social hierarchy; it was feared that the classics based education for the higher orders, which had insistently excluded instruction in science, would prove ineffective for the domination of 'scientifically' trained mass of the poor. Voices from various influential quarters rose to express the perceived social danger in imparting a superior education to those inferior in position. Eminent scientists like Lyell and Faraday joined in explicitly stating that "..from a political point of view, it is not only an unhealthy but also a dangerous state of things in some respects, that the material world should be very much better known by the middle classes of society than by the upper classes". A double-edged campaign backed by the newspaper. The Times advocated the introduction of 'pure'

science, fit for the 'superior' mind, in the liberal curriculm for the higher orders and, simultaneously, a halt to the practical science education of the lower orders since it had become 'too good' and expensive for them and was''.. too far above basic literacy (required) for bible reading''. As a result science was soon removed from the elementary school curriculum on the grounds of inadequate funds and trained teachers. It was further stressed that a ''..knowledge of common things was not to be obtained by the direct study of science, but through country walks, star gazing and domestic experience''. Two decades later when science reappeared in the school it was in a form very different from that envisioned by the radical 'science for liberation' advocates. The goal of 'pure' science in schools, as expressed by its new supporters, was to inculcate habits of 'value-free' and 'disinterested' inquiry 'for its own sake' in order to prepare future scientists for universities. In the words of an eminent professor, ''..teaching of science in schools was to be a means of shifting out of the great mass of the people those golden grains of genius which are now too often lost amongst the sands of mediocrity''.

Science in the school curriculum thus became defined as a highly selective sieve to sort out those few who conformed to the image of the 'pure scientist'. Indeed, the mass of the populace for whom it was a resource accessible only in theory, were effectively deprived of any meaningful education in science, owing to its intended abstraction and aloofness from matters of their everyday lives and belief systems.

One can clearly see the influence of such formulations for school curriculum right through to post-independent India, until the present day. The irrelevancy of the primary and middle school curriculum content, particularly in relation to the rural and advasi populations which form a large majority of total school going children, has been pointed out repeatedly over the years. But the overriding factor influencing each curriculum revision and change has been to accommodate more and more of specialist science in lower classes, with the justification that there is no other way to cope with the 'information explosion' than to push in more and more information into the curriculum. Under this onslaught, all criteria that have a socio-political bearing, or even such considerations as age-concept correlations, have been swept away. So, if it is necessary that the physics of atoms and molecules has to be pushed down to class5, because more information needs to be accomodated in class 6 onwards, then so be it. Whether class5, or, for that matter, even class

8 students can actually make any sense of the concept of an atom is no longer a consideration .

Together with prevailing pedagogical methods, the 'pure and abstract' information based curriculum constitutes an extremely strong repressive tool of people's minds. An authoritative and one-sided mode of communication, mediated by the all-imposing teacher from whose lips flow pearls of information that is alienated from the entire life values, aspirations and concerns of the sullen recipients constitutes, nearly wholly, the school transaction. A counter-hegemonic action therefore has a dual role - in intervening in the curriculum and in the pedagogical, teaching learning methods.

The Hoshangabad Science Teaching Programme :

With this background of the historical evolution of the science curriculum, shaped by dominant concerns and interest in a stratified society, we shall now examine an on going programme that has attempted to re-establish the Dewian vision of science education in a, hopefully, counter hegemonic manner. Naturally, it has meant conflicts in various areas and at various stages. In what follows, we shall confine ourselves to discussing some of these conflicts rather than a chronological narration of the whole programme. These provide further insights into directions that educational action could take within a PSM framework.

At a pedagogical level science education offers a straight forward methodology with far reaching effects - that of activity based teaching. Implementing such a methodology has been one of the main concerns of the Hoshangabad Science Teaching Programme (HSTP). This seemingly simple sounding change, when practised, particularly in the more feudally oriented rural schools, has been shown to have the power to break down the usual notion of teacher - child interaction. Such breakdown includes the reorientation of the classroom architecture where rows of 'disciplined' and silent children sitting in neat rows are liberated into groups of excited and chattering bundles of energy and joy, engrossed in their activity at a level of 'indiscipline' or freedom, that is so essential for the transaction of critical knowledge. Science at elementary school levels also offers the opportunity to generate information through experiment and activity, making it less binding to supply it through comprehensive texts. Thus, it is possible to bring a sense of discovery into action, and this has been the other major attempt of HSTP. However, the balance between the amount of information that can be generated and the amount that needs to be supplied, particularly in higher school is a

matter that requires further delineation through practice. Even so, it may be contended, on the basis of about seventeen years of cumulative experience of HSTP, that in areas where information generation is difficult and facts have to be suppliied, a method that retains a critical mode is very much possible.

At the level of content, HSTP has worked under a constraint. Since the programme was initiated by choice, in rural government schools, and expanded within the same system, the number has risen from 16 in 1972 to 411 in 1988. An operative condition has been that the syllabus should remain essentially the same as prescribed by the State Board, to ensure 'parity' with non-HSTP children. It would of course have been easier to overcome this constraint by opening one's own schools, but the major objective of the programme has been to attempt changes within the organised education system, rather than prove the viability of a few islands of excellence. However, a major area of confrontation, over the years, has been precisely around this aspect. For example, contrary to the prescribed syllabus, we have omitted chapters on atoms and molecules and chemical formulae, which we contend are too abstract at the middle school level. Similarly we feel that the correct place to bring in the concept of mass is when one takes up Newton's laws of motion (in high school). The space provided by these omissions has been utilised for a much more thorough going treatment on learning skills and concepts of measurement, decimals, flowers, crops and vegetables in the immediate environment, genetic diversity in nature using the village environment as a laboratory, and elementary notions regarding change and probability. And all this through the mode of activity and experiment. Inspite of this, it has generally been felt that the curriculum could, and should, be made more and more relevant to the local environment. In this environment is included, the social and cultural environment. For example, the attempt to use a simple and straight forward language is another point of confrontation, with the mechanical educationists and scientists showing grave concern over the simplification, or omission, of technical terms.

The sustained attack on HSTP regarding the omission of topics like atoms molecules reveals the same tendency favouring 'pure' science as described in the previous section. Similarly, the insistence on a precise, 'objective' and dry language, replete with technical terms is to be viewed within the context of the particular function of science education that considers school education primarily as a training ground to produce stock scientists and technicians. That science education could have a social function in creating avenues of

critical thinking, is implicitly denied by such a contention.

A major area of confrontation, and innovation, has been that of kit materials. An activity based method obviously requires a certain amount of such materials. But within the Indian rural school system, this is considered a luxury by official standards. Within the priorities, determined by the overall economic and political considerations, a demand for such expenditure produces an incredulous response. The mention of a science kit possibly conjures up images of expensive laboratories, glittering glassware, winking digital lights and all the other science stereotypes many science institutions and media have established. Isn't science apparatus after all an expensive business?

It is a matter of despair that even after seventeen years of HSTP, such stereotypes should continue to dominate the thinking of a large section of scientists and educationists. Such thinking persistently reveals a shocking ignorance of science and its method, in particular, as needs to be practiced in elementary schools. There are a variety of ways in which such ignorance gets expressed. Consider the following statement that "..in science precision and exactness is everything, so, apparatus and instruments must be accurate, and hence, expensive". Similarly, it is assumed, without question, that packaged instruments, more or less in the form of black boxes, is science apparatus, thinking with it science, but opening it to see its insides is spoiling it and hence, taboo. Conversely, constructing apparatus from ordinary bits and pieces is at best a hobby and play, not real science.

The chapters on measurement in HSTP workbooks, called Balvaigyanik, illustrate how some of these notions have been questioned. Take 'exactness' and precision for example. At training workshops teachers are asked to measure the same length, say that of a classroom, individually, and record their observations on a piece of paper. All these obsrvations are then written down together on a blackboard. The teachers are horrified to see the variation and discussion ensues on the causes. Satisfied, they remeasure that same length, to discover that the variation, though less, still persists. Naturally, they feel very uneasy because their notion that science is 'exact' is shaken because they find it impossible to define the length of the room exactly. This then is the take-off point for a vigorous discussion on the notion of exactness in science, the unavoidable use of statistics in defining the length of the room from a set of actual measurements and so on. This is what then gets transmitted to children, and acts as a motivation for the use of the scale for

measurement, thereby continuously reinforcing this important skill. So, by actual practice students and teachers realise that no matter how careful you are, repeated measurements produce variations which are ultimately linked to the resolution of the measuring instrument. So, 'how exact?' becomes a contextual question rather than an absolute notion. A carpenter needs accuracies of the orders of millimetres whereas in measuring road distances, variations by a metre may be normal. To insist on milimetre accuracy for such measurements for normal purposes is not really scientific, but silly.

Now all this gets done using essentially the child's standard 15 cm plastic scale and a wooden half-metre rod. To build up such an understanding of measurement, it is unnecessary to invoke vernier callipers, screw gauges and the like, which are usually considered an essential part of school science, and cost much more. It is not as if children should not be exposed to these measuring devices at some time or the other. The point is that if they are not available for any reason, measurement can still be learnt with deep insights by alternative means. In fact a mere use of these instruments without bringing out the deeper questions is a fairly superficial exercise.

Other innovations in the kit involve the use of a single item for many purposes. A stirring example is that of the plastic cube. This one centimetre cube now costs about 10 paise and is extensively used in learning concepts like area and volume. But being of nearly the same density as water, it is also an adequate measure of 1 gm. of weight and is so used in many weighing experiments. Finally, in the interesting chapter on chance and probability, the same cube finds use as a dice.

A famous example, told and retold many times is about the 'babool ka kanta' (babool thorn). Initially a dissecting steel needle, costing nearly a rupee, was part of the kit for biology activities. A school teacher found, in the babool thorn, a local and freely available substitute. The needle has since then been removed from the kit and the all purpose 'babool ka kanta' dominates all activities requiring puncturing, impaling or dissection.

Such an atmosphere where innovations, substitutes and new ideas are constantly sought has ensured that many of these ideas come from children and teachers. Infact the degree of innovation exhibited by the rural school teachers has been a great source of inspiration of resource scientists of the programme who come from such institutions as T.I.F.R., Delhi University and I.I.T.'s. The used ball-pen refill is another example. Available easily in all schools from

children and teachers, this throwaway object combined with a flattened paper clip has emerged as the best method of making an axle for a variety of toys, games and apparatus. Similarly, ordinary buttons, sealed back to back under a candle flame provide multipurpose wheels and pulleys, and are the basic resource tools for a chapter on machines.

The ingenuity of the teachers and children surprised many chemistry experts when it was found that they had discovered that purgative tablets (like Vaculax) contained phenophethalien and could be used as an indicator for titrations. This discovery has spurred further activity in this field with teachers, children and resource persons combining their ideas in exploring flower petals - of hibiscus, marigold et cetera - as indicators, because it is observed that many of them change their colour on addition of acids or alkalies.

Apart from such innovations, the simple pedagogy employed in HSTP is that of field visits. Soil profiles, crops, pests, insects, flowers, life cycles of mosquitos and frogs and numerous such activities require no more than a friendly guide, who could be the teacher, the local patwari, gram sewak or health worker and an acceptance of the fact that more enriching and environment linked learning situations exist outside the four walls (if any) of the classroom. The joy and enthusiasm and the liberated feeling on the childrens' faces can be infectious.

These innovations are however another cause for conflict and confrontation. A criticism often expressed by 'experts' is that it is at best 'picchda Vigyan' (backward science). By confining children to the bits and pieces of the 'poorly' endowed rural environment, children are denied exposure to 'modern' science as reflected by spacecraft, nuclear reactors, winking and blinking instruments, computers et cetera. Such criticism often finds expression in sentences such as "..Man has reached the moon and you are still asking children to use babool thorns". It is a matter of deep regret, that 'good' science and all of education has got linked to the arrival of a computer or a video in a few schools of the country. That science or any form of learning is discovery, curiosity, activity, imagination, participation, manual skills and critical thinking is being swamped and over-run by incomprehensible and alienating technological gadgetry, thereby undermining the purposeful role such gadgets could have if properly incorporated into a sensible education programme. And since it is virtually impossible that such gadgets can reach each and every school of the country, their presence in a few (like Navodaya

Vidyalayas) shall further strengthen the stratification process.

What about the costs? For a school with an average of 40 children in classes 6, 7 and 8, that is for about 120 students, the initial cost of the HSTP kit is less than Rs.1,500/-, i.e. about Rs.12/-per child. The replenishment costs of consumables and breakage works out to rupees one and a quarter per child per year. These figures are borne out by sixteen years of experience and are not mere projections. Surely, such an investment is not outside the possibilities of State Government budgets, in any case they are a right of every Indian child.

An area of intense effort has been in teacher orientation and involvement. In fact it is this area that comes closest to the Gramscian ideal of increasing the component of 'good sense'. Sustained effort through large-scale orientation and training camps and monthly meetings have by now involved and equipped about 1800 teachers in all aspects of the programmes, like book writing, kit improvisation, open book examination, and conducting an activity based methodology. This has succeeded to the extent that many among them have become inventors of pedagogy rather than mere mediators of a pedagogy.

The level of confidence attained by many of the teachers is quite unheard of amongst the administratively exploited rural middle school teachers of Madhya Pradesh. The following is one such illustrative example. The resentment of the local political forces has found expression in diverse ways over the years, mostly unrelated to the teaching-learning process. However, one such onslaught took the form of the local ruling party congress MLA (now a Minister) demanding in the state assembly the closure of the programme since it was teaching gambling (satta) to children. His outburst was against a question framed for the board examination by a group of local teachers concerning the unit on chance and probability. The question asked chidren to compute the probability of winning a bet on a two digit number commonly used in satta playing. The question further enquired of the children to deduce whether the whole enterprise was a losing or a winning proposition for the player. The MLA, totally unaware of the content or intent of the question surmised that since the word satta had been used in the question paper, and since HSTP stressed activity, the two together must imply that children were being exhorted to practise satta in and out of school. The question was messed up in the state assembly and ultimately it transpired that concerned teachers were asked to submit a written explanation. In

a spirited defence, they maintained that satta was a social menace and the study of chance and probability provides a clear rationale to prove that it was eventually a losing proposition. This, they maintained, was a much better condemnation of the practice than all moral appeals. In particular, they questioned the contradiction in the official position, which on the one hand exhorts teachers to provide links between what goes on in the school and the society outside, and precisely when this is done, charge-sheets them. So forceful and logical was their reply that any notions the State may have had for punishing them, quickly evaporated.

Though this was a strong expression of the teachers' acceptance of the values of science and society, and somewhat high profile because of the accompanying sense of drama, it wouldn't be an exaggeration to suggest that such an expression was not an isolated event and that in many subtle and low profile ways such reorientation of attitudes and values has been widespread. That it will and should lead to further conflicts is clear, but in a sense, that is also a measure of achievement of the programme.

However, it is necessary to sound a word of caution regarding the 'romance' of conflict situations. Increasingly, many practitioners of educational and PSM action tire, over the years, of low profile non-agitational work and feel the need to switch over to overtly more radical paths. It may partly be because of the Gramscian assertion that the degree of stability of the status quo is reflected by the ability of the existiing hegemony to accommodate alternative and counter-hegemonic cultural forces, neutralising, changing or actually incorporating them. Such a feeling could be a cause for practitioners to seek direct conflict situations because of the sense of adventure and self importance they provide. This is not to deny, ultimately the need or validity of such situations, but of essence is the processes that lead to such situations, rather than the incidents in isolation. In Gramsci's words, "..resort to violence by a subaltern class is not a sufficient condition for establishing its own hegemony, this requires a profound change in mass consciousness", and, "..there can, and must be hegemonic activity even before the rise to power, and that one should not count only on the material force which power gives, in order to exercise effective leadership". Hence the rubric, "Instruct yourselves because we shall need all our intelligence. Agitate because we shall need all our enthusiasm. Organise yourselves because we shall need all our power".

PSM groups require to reflect deeply on these issues, to understand and carve out a role, in harmony with other forces, like

scattered intellectuals, not necessarily scientists, trapped in universities, medical colleges and other such institutions, ordinary people and in particular, progressive political parties.

Notes & References :

1. Ramachandra Guha : 'Modern Science - That Holy Cow', Frontier, April 27, 1985.

2. For example, at the I People's Science Congress, Cannanore, February 1988.

3. Gramsci's own writings are to be found in the well-known 'Selections from prison Notebooks', Lawrence & Wishart 1971. A critical reading, on which this account is based, is to be found in Harold Entwhistle's 'Conservative Schooling for Radical Politics', RKP, 1979. It should be made clear that the reference to Gramsci's views is not in order to invoke a sense of authority, nor is it meant to open up controversies within the Marxist framework regarding 'Humanist Marxism', 'Western Marxism', 'Euro-communism', 'Base-Superstructure' et cetera. This is neither the place nor the occasion to get involved in such debates. It is just that these views seem to have a contextual validity.

4. This account is to be found in Anita Rampal's paper 'School Science in Search of Democratic Order', Nehru Memorial Museum and Library, 1988. This paper, amongst other things, traces in detail the evolution of the science curriculum, as shaped by social and political influences.

5. Many accounts of different aspects of HSTP are available, for example: Science Today, December 1977; India Today, July 1984; Economic & Political Weekly, No.42, October 15, 1988, and People's Action, CAPART (forthcoming).

This theme paper on Science education was presented in the second All India People's Science Congress by Dr.Vinod Raina, on behalf of EKALAVYA. Ekalavya is a voluntary organization which has done tremendous work in developing new low cost science kits and science teaching methods for rural school children. They decide the entire syllabus and conduct the teacher training in all schools in almost 14 districts of Madhya Pradesh. Their methods have been very successful and has won them national recognition.

"ENVIRONMENT AND DEVELOPMENT" TOWARDS A PERSPECTIVE

BY KERALA SASTRA SAHITYA PARISHAT

INTRODUCTION

Protection of environment is one of the issues that has attracted worldwide attention and generated a lot of discussion and debate in recent years. Environmental protection and management have become one of the items of state expenditure in most of the developed and under developed nations. Major development projects are beginning to be evaluated on the basis of their environmental viability. Protests have been growing against such projects that have caused or are potentially capable ofcausing destruction of environment. Ecology groups are actively functioning in almost all developed countries. Recently, political parties have been formed on the basis of ecological issues and slogans in most of the countries in Europe and North America. In Germany, Sweden and Belgium they have found representation in their respective parliaments.

Environmental awareness has been growing in many socialist countries also. China has considered environmental protection as an integral part of their strategy of development ever since the Revolution. They have also initiated programmes for wide scale afforestation, recycling waste material and adoption of environmental safeguards for development projects. Soviet Union is also keen on the protection of environment. Environmental issues have figured prominently in the debates on the problems of development in Soviet Union, which includes the pollution of Baikal Lake, environmental degradation facing Aral Sea, Siberian rivers etc. Atmospheric pollution of the highly industrialised Ukrainian cities have also raised important problems regarding industrialisation. The CPSU has stated in their social and economic guidelines adopted by the 27th party congress that among their major tasks is the effort

> "to improve the effectiveness of environmental protection measures. To introduce low-waste and waste-free technological processes on a broader scale. To develop industrial complexes that ensure complete and comprehensive utilisation of natural resources, of raw materials and supplies and that exclude or considerably lower harmful effects on the environment"1.

It has also been stated that among the global tasks that should be urgently taken up include "to wisely use breakthroughs in science and technology... to protect the environment"2.

Environmental awareness in the underdeveloped countries is also growing. This is manifested in Fidel Castro's report to the Seventh Summit Conference of Non-Aligned Nations in 1983, which gives a detailed examination of the environmental degradation of the third world countries3. A number of environmental issues have been raised in India itself including Silent Valley, Bedthi dam, Tehri dam and recently the Narmada Valley Development Project, and successful actions have been carried out on some of them. Destruction of environment and depletion of natural resources are being regarded as one of the vital concerns of many third world countries, who are trying to build their economy and social life.

What is the nature of the environmental problem? How did environmental questions come to attract so much of attention during recent years? What is the perspective of People's Science Organization in the country on questions connected with environment? These are the main themes dealt with in this paper.

The Problem

Debates on the question of environment have been taking place simultaneously on three different planes: a) on specific issues connected with environmental degradation raised by concerned groups and individuals for which solutions are sought at a practical level; b) issues of environment treated as a part of world development, in which different developmental strategies are discussed and debated; and c) environment treated on a theoretical plane as a problem of the historical relation of man and nature, and therefore, linked with the future of mankind. Often these three planes of debate of (conflated) in which the issues have become merged with predispositions and value judgments of those who have participated in the debate.

In the first plane, environmental problems are mundane and practical. They include the so-called "geo-environmental problems" like over exhaustion and degradation of the soil, depletion of fossil fuels and other non-renewable energy sources, deforestation, growth of salination and siltation, increase in the toxicity of earth's surface, pollution of water etc. Disposal of hazardous waste in urban industrial complexes have become a major issue in developed and also some of the underdeveloped countries. Atmospheric pollution through the emission of carbon dioxide, oxides of nitrogen and sulphur dioxide

and the creation of the so-called "acid rains" have attracted attention for some time. Recently it has assumed a new dimension with the discovery that the atmosphere has been 'heating up' over the past few decades as a result of the "Greenhouse Effect" caused by increasing concentration of CO_2. Equally alarming has been the discovery of the fissure in the ozone layer which acts as a protective shield against ultraviolet radiation, which is found to be the result of the use of chlorofluoro-carbons in industry.

Questions have also been raised regarding the destruction of the "biosphere" including plant species and animals mainly due to deforestation, desertification and wanton destruction of flora and fauna. The effects of the degradation of the soil and increasing pollution has been shown to have adverse effect on human beings also. The famines in Africa have been linked with ecological degradation and desertification caused by human intervention4. Depletion of natural resources have contributed to the misery of the people in the third world countries, and even the developed nations have been affected by it. This has been compounded by radiation hazards in the use of nuclear energy and the creation of toxic wastes while using fossil fuels. The close link between environmental issues and the survival and spread of life forms including human beings is being recognised.

The survival of human beings is also a question of their social forms. The social aspects of environmental problems, including pollution of drinking water, malnutrition, squalid housing, depletion of fuel and fodder, inadequate sanitation and spread of epidemics have been central points of the debate. Poverty, in the third world countries and even in some of the developed countries have been linked to ecological degradation. Some environmentalists have raised the issue of the population growth and the inadequacy of the world economy to provide for their material needs. Some others have argued that the increasing cost of production itself will be a drag on the world economic growth and will make production more and more unprofitable, while increasing the misery of the people.

At this level of debate, environmental issues look like a question of finding scientific means for disposal of hazardous waste, introduce recycling measures, provide adequate checks for the use of natural resources, prevent deforestation, preserve bioforms, introduce birth control measures and take immediate measure for alleviating poverty. There have been state departments for environmental protection, forest conservation, and pollution control that have been set up to

deal with such questions. But they have not been able to reverse the trend so far. Their failure is not merely a question of functional efficiency, as it involves effective strategies of development, and the role of environmental issues in such strategies. Here the debate assumes a different level.

The term 'eco-development' was used at the 1972 Stockholm International Conference, and it has been a controversial term ever since. The term "eco-development" has meant a "process of ecologically sound development, of positive management of the environment for human benefit". However, opinions have been divided as to what an 'ecologically sound development' means. The term has symbolised the adoption of alternate development strategies. Such strategies have stressed the shift from the use of non-renewable energy sources to renewable energy sources like the sun, wind, air and from hard-energy options like nuclear, coal, oil etc. to soft-energy options like wind, sun, biogas etc.; reduction of consumption of energy forms and the use of alternate technical devices. Many alternate forms have been experimented in both the developed and developing countries and used to complement the existing development strategies, as shown by the experiments on solar energy, biogas etc.

However, there is a very strong current of opinion among the environmentalists to use the alternate development strategies in a consolidated form to oppose the present concept of development itself, a trend that was set in motion by the theorists of the club of Rome. For the club of Rome the present form of world development has been that of exponential growth, involving the over-exploitation and destruction of natural resources and a process which is essentially anti-human. If human kind continues to adopt the present form of development, then its future appears to be very bleak with the future population likely to live in a barren, degraded environment, devoid of natural resources. This will be complemented by exponential growth of population5. Although many predictions of the original Club of Rome report were found to be inaccurate, their arguments have been used by other environmentalists to attack the present form of development, and to predict an "ecological catastrophe"6.

For several theorists of the 'ecological catastrophe' the term "the process of world development" was always very loose. Although for most of them world development meant the development strategies of western capitalist countries, they did not specify it and used it for the entire world, including socialist countries. The dynamics of

capitalist development during the past centuries and the forces that led to the growth of the socialist path were overlooked. Industrialisation and exploitation of natural resources per-se became the target of attack, and alternate strategies were based on idealist premises. Achievements in science and technology also came under attack without looking into the context in which new scientific discoveries were made and new technologies developed. Instead of attacking the forces that controlled scientific research, science itself was negated. Ecodevelopment thus meant a repudiation of all existing forms of production and utilisation of resources, and ecology was glorified as the real alternate "human" science.

These developments have resulted in the phenomenon of ecological politics as shown by the growth of numerous 'ecology parties'. Such parties have not only been demanding the adoption of ecodevelopmental strategies, but also the reconstruction of the entire society and polity on ecological basis, transcending the present national boundaries. These parties are attacking both capitalism and socialism as shown by the slogan "We are not the Right and the Left we are always in the front"7. Some have even tried to link ecological questions with eastern mysticism and adopted an antidevelopment, antiscientist position including the call for "return to nature"

For them, protection of nature is the primary task for saving humankind from its impending doom. Thus the environmental issues are separated from the other contradictions in modern societies, and used in a reactionary way to blur the exploitation of man by man, which is inherent in capitalist societies8.

However, some ecology groups have been trying to differentiate themselves from these popular, but reactionary perspectives. They have tried to view environmental degradation from the point of view of the human degradation itself and have evolved a theory of "social environmentalism9. They have counterposed the idealist and reactionary ideas of some environmentalist groups, with perspectives based on a concrete analysis of the world development from its social as well as natural dimensions. They have also tried to integrate the environmental problems with issues that cause destitution and misery of the people and have sought to form a cominon platform with the movement to liberate the labouring masses from their exploitors.

The social environmentalists are expressing the concerns of the revolutionaries of the 19th and early 20th centuries who fought not only for the liberation of mankind from exploitation of man by man, but also for a radical restructuring of the conditions of labour itself,

an environment in which decent human life is possible, and of the adoption of technologies that will aid this restructuring. This concern is now reflected by the social environmentalist perspectives.

Debates on environment and development, along with alternate developmental strategies have resulted in a third level of debate, on the question of man-nature relations, and aims of scientific research. The political ecologists have argued that man has overused and over exploited nature and, unless the balance between human action and natural processes are restored, no progress is in store for humankind. Efforts have been made to write history as the rise and fall of ecosystems. Growth of science and technology has been viewed as devices upsetting the man-nature balance which has resulted in destitution and misery for the people.

Man-nature relations have once again been brought to the attention of scholars who do not espouse idealistic, antiscientist views. Efforts have been made to define objectively the relationship between man and nature. Such efforts have emphasised the dialectical relation between man and nature. History has been seen as the expression of the conflict between the mode of production of life itself and the conditions under which the human factor develops. Evolution of humankind is seen as a process of surmounting this conflict. An integrated approach involving the aspects of population, material production and geographical environment is sought to be formulated. Man-nature relations are seen as an organic relationship, the basis on which man produces himself and his material life10.

Thus the problem of environment has generated a debate of several dimensions ranging from concrete issues of application of science and technology in industry to abstract problems of man-nature relations. It has also been shown how the positions of certain ecology groups have tended to become idealistic and anti-developmental. However, the problems that the environmentalists have tried to pose are extremely serious and cannot be overlooked by any one with concern about the future of humanity. They present features of a new reality that has been developing in our times, which has to be analysed and understood by People's Science Organisations.

Genesis of the problem

Environmental problems that we face today have their roots from the beginnings of capitalism itself. Capitalism developed by the naked exploitation of resources by capitalists in their own countries and in

the colonies estalished by them. The laws of capitalist development necessitated more and more intensified exploitation of resources, utilisation of every available material form and energy at a global level. Depletion of environment has been the result of this process. Along with exploitation of the physical environment, the working people were subjected to inhuman conditions of existence under the capitalist system. The literature of 19th century is replete with descriptions of working class life in Europe. Charles Dickens' novel "Hard Times" and the descriptions of working class life in France by Victor Hugo and Emile Zola are best examples. Social revolutionaries of 19th century, fighting for the liberation of the working people, also dealt with the environmental question. Frederick Engels, described in detail the destitute living conditions of the working class in England in 1844, and returned to this question in the pamphlet "The Housing Question". Engels discussed the question of relations between Man and Nature, and also the implications of capital's exploitation of nature for the future of mankind. Man-nature relations were understood as an integral part of the process of production and the conditions of the working class.

The early half of 20th century brought about significant changes in the development of capitalism. Capitalism had developed into a global system characterised by concentration of capital, and growth of transnational cartels and corporations, and the division of the world market among major capitalist powers. Intense competition among the capitalist powers for resources and markets stepped up the exploitation of nature and plunged these powers into two wars. Both wars devastated the environment within these countries and elsewhere in the world. The period between the wars saw the worst crisis that capitalism had experienced until then. Visions of smooth development of capitalism, prevalent in 19th century, vanished. Resistance to capitalism mounted. The political power of the working class was demonstrated by the Russian revolution which made an alternate strategy of development a working reality. Resistance also developed in the colonies. National liberation movements emerged and the process of decolonisation was under way. These processes, which intensified after the II world war, further restricted smooth development of capitalist exploitation.

Capitalist development during the post-war period has been characterised by a) intensified exploitation of natural resources and the development of technologies that would increase productivity and reduce the deployment of human labour power b) Expansion of "Energy Industry" from fossil fuel to nuclear energy c) growth of

armament industry for economic gains by the sale of weapons, and for global political domination. All these features are linked to the tremendous growth in science and technology, which is sometimes characterised as the scientific-technological revolution. The growth of science and technology in the last few decades has brought about a quantum jump in man's ability to exploit vast resources of energy hitherto unharnessed. The destructive potential of these resources has also been beyond the wildest imagination of mankind at any time in history. The environmental problems that were developing could be directly linked to the harnessing of these tremendous sources of power. A major environmental crisis had developed when Nazi battalions had devastated the rest of Europe and atomic bombs were droped over Hiroshima and Nagasaki. The atomic bomb resulted in almost permanent damage in the living conditions of the people in these cities. Visible effects of environmental destruction through war was demonstrated in Cuba and Vietnam. Bacterial warfare that destroyed livestock was unleashed in Cuba, and in Vietnam, chemical warfare destroyed both vegetation and human beings. Concentration of armaments along West Germany and the rest of Europe to counter the "threat from behind the Iron Curtain" exposed the European population to the dangers of nuclear radiation and the pollution of their waters and atmosphere.

Intensive use of natural resources and energy forms was part of the effort to maximise production and establish control over every available part of global market. It was what the Club of Rome called "Exponential Growth" This growth process, which has become a part of capital accumulation and generation of profit, has contributed to the development of environmental issues.

A third feature also contributed to the rise of environmental issues. The newly liberated nations in their effort to rebuild their battered economies, faced innumerable problems. These nations had been subjected to intensive exploitation of resources under colonialism, and they faced difficulties in their resource mobilisation and development. Developed capitalist countries adopted new manouveres to sustain their exploitation of these nations and bring them under their economic or political hegemony. The third world countries bear the burden of environmental problems as they face resource depletion due to continuous exploitation by the developed countries. The developed countries are using the underdeveloped countries as waste baskets for dumping their outmoded technologies and use the people of such countries as guinea pigs to conduct their "experiments". These trends have further deteriorated the already

destitute living conditions of the people of the third world countries. The policies of some of the third world governments who are following the capitalist development strategies have also accentuated these problems. The callous way in which the MNC's operate in third world countries was examplified by the Union-Carbide induced Bhopal massacre.

The environmental problems that have developed belong to two broad categories i) Immanent problems in a particular region or nations created by specific developmental strategies and exploitation of natural resources. Immanent problems are of two types, micro problems that affect the life of the people directly like drinking water, sanitation, disposal of waste, housing etc. and macro problems that effect the life of a region like deforestation, desertification, pollution of water and earth's surface. These problems may vary from nation to nation. Variations are larger between developed and underdeveloped nations. For example, the immediate risk of nuclear hazards, radioactive waste, will be more in advanced capitalist countries 2) Ecological problems of global nature, which includes the global greenhouse effect, hole in the ozone layer, environmental effects of nuclear war etc. The latter problems are less apparent but are the cumulative product of the specific problems in each region or nation in which the total contributions of developed countries is much greater. Since capitalism is a global exploitative system, its impact on human living conditions also is global.

The environmental awareness of our times developed in this background. It emerged from two entirely different sources. One, from the scientific and technical intelligentia of advanced capitalist countries, and the other, from individuals and activist groups who have been on the fringes of political activity. The ecology movement has not been directly linked with radical political movements either in advanced capitalist countries or in the underdeveloped countries.

The period after the second world war saw the rehabilitation of the major capitalist powers helped by renewed exploitation of resources, growth of science and technology and the financial and military "umbrella" provided by United States. The vigorous optimism shown by capitalism in the fifties and early sixties transformed into despair by the end of the sixties. The oil crisis of the seventies raised the question of a possible resource depletion even in major capitalist countries. The growing crisis in the world capitalist economy towards the beginning of the seventies corresponded with the postulates of the "environmental crisis" and demographic disaster

propounded by the intelligentia of the advanced capitalist countries.

Several popular movements against the state in advanced capitalist countries also developed during late 'sixties and seventies'. Some of these popular movements claimed themselves to provide a new alternative to capitalism. The environmental groups in advanced capitalist countries developed from these movements. Many of the solutions proposed by these ecologists include "soft energy options" 'human technology' "ecological communities" etc. are unrealistic. They do not come into grip with the fact that the basic of environmental degradation does not simply lie with technology used alone, but with the way in which it is used. Subjective factors like 'personal greed' and 'craving for power' are used to explain the antipeople use of science and technology11. This reduces a serious historical problem into a moral problem and provides a moral solution of the conscious use of alternate technology. Changing technological modes does not alter capitalisit exploitation itself. The ecologists are not concerned with the removal of exploitation which they hope will be removed with the change of technology itself.

Most of the ecologists tend to distinguish between the 'economic' and 'ecological', placing economic problems as a part of 'traditional' growth models. The creation of this dichotomy, fashionable in the ecological circles of the West, is also being increasingly used in countries like India. This obscures the linkages that the environmental problems have with the degradation of the material life of the people, as a result of economic exploitation, and the struggle to alleviate their conditions.

Transition from capitalism to socialism has not, automatically, caused any major change inthe environmental situation. Efforts by socialist countries to build their industry and intensify agricultural production, have resulted in environmental hazards. Recently, many Soviet theoreticians and environmentalists have criticised very strongly the identification of social development with technological growth alone. Socialism entails a change towards fuller satisfaction of people's social needs and raising their material and cultural standards of living. Soviet theorists point out that inside Soviet Union" cases of an unsocialist attitude to natural resources are still met, and views that are unmistakably survivals of an unbridled consumer attitude to nature, that cannot but cause us alarm, and against which we are waging a resolute struggle, combined with broadened work to educate the working people ecologically"12. This point has been strongly brought out in the CPSU Central Committee

meeting which discussed the implementation of the measures "to ensure protection and rational use of Lake Baikal Zone". Yegor Ligachev, Politburo member of the CPSU stated that "the party and government organs of the region are not vigorous enough in coping with practical issues that call for improving the ecological situation and overcoming a consumerist attitude to nature"13.

The relation between growth strategy and ecological issues is clearly brought out in another CPSU resolution as the ecological improvement of Aral Sea area which stated that "Major errors were made during the establishment of agro-industrial complexes for growing cotton, rice and other crops there: New areas of irrigated land were put to agricultural use without due account for ecological and social consequences. As a result, a bad ecological situation arose there"14.

It is clear that the CPSU and the Soviet scientists are criticising and correcting the mistakes in their development strategy and fighting what they call "consumerist" attitude to nature. Soviet theorists advocate the "ecologisation of industry" in the context. This has meant the introduction of waste free production cycles, rational use of natural resources, and ecologically harmless technology15. These concepts have been incorporated into the official documents of the CPSU where environmental protection is intended "to make more rational use of water resource"; "to perfect, to this end production processes, equipment and means of transportation"; "to ensure rational utilisation of land"; "to step up measures for the protection, reproduction and rational utilisation of the vegetable and animal kingdoms", and "to develop in Soviet people a sense of great responsibility for conservation and increase of natural wealth and for its thrifty use"16. It is obvious that environmental protection has become an integral part of the socialist development strategy, to ensure rational mobilisation of resources, their productive use and distribution.

Towards a theory of environment

India too has got its share of environmental problems and also environmentalist groups. The major environmental issues can be classified as follows:

a) Those connected with the deforestation, and consequent problems, of the slopes of the Himalayas, the Western Ghats and other mountain ranges.

b) Those connected with major development projects like Tehri Dam, Narmada Valley Project etc.

c) Those connected with Nuclear Power Stations and other installations.

d) Those connected with irrigation, drainage and land use.

e) Those connected with polluting industries - chemicals, paper etc.

f) Those connected with poverty, malnutrition and squalid living conditions of the people.

In every region and state, one can find some of these problems in their nascent form, others in quite aggravated forms17.

Although nature study groups like Bombay Natural History Society have been existing for a large period, environmental activism is less than a decade and a half old in India. The well known example of Chipko movement developed as an act of self-preservation and, therefore, was not just a movement for environmental protection. A more direct environmental movement was that of the Silent valley. The proposed hydro-electric project at Silent valley, Kerala, did not pose any immediate threat to the livelihood of anyone. It was taken up as an ideological issue of national importance. Spontaneous reaction to atmospheric and water pollution caused by chemical and heavy industries in a number of places gradually developed into systematic environmental groups. Thus there are literally hundreds of groups scattered throughout India. Of late many of them have been getting together for collective action. By and large the leadership of all these groups belong to the middle class intelligentia. However there are perceptible differences discernible amongst them. Bulk of the environmental groups in India, generally counterpose ecology to development, tending to become anti-science, anti-technology and in effect, anti-development. They have their own definition of development, which is different from both capitalistic and socialist development. Many of them, conciously or unconciously adopt the line "back to nature". Some of them even languish over an 'Indian science and technology', which is supposed to be basically differenct from the Western science and technology' and more humane. As a reaction to these groups, a sort of anti-environmentalism is also gradually emerging. One can call them "mechanical developmentalists".

Opposed to anti-environmentalists and pure environmentalists, there are a few groups, who may be called social - environmentalists. The KSSP is a leading example of these groups. They reject the formulation by the many ecology groups of the West and India of the dichotomy of "Economy" and 'Ecology' and their attempts to counterpose "Ecology"to the achievements of science and technology.

However, they emphasise the crucial importance of environmental problems in India and the world. Developmental strategies with scant regard to human living conditions and human relation with nature have created environmental degradation and resulted in further deterioration of the living conditions of the people of India. Such strategies have resulted in the degradation of fertile agricultural lands, and created numerous cases of avoidable industrial pollution. Squalid living conditions and polluted air, water, and land are creating grave health hazards to already destitute and pauperised millions. A scientific critique of the present development strategy in India cannot be carried out without emphasizing these factors, and any movement for the reversal of the present strategies, too, will have to take up these issues.

One can envisage that what is commonly known as environment has three components 1) Physical conditions of human existence, which includes physical environment including geological conditions, water resources, atmosphere and natural wealth and, the biological conditions that sustain material life including protozoa, plants, animals and forest systems 2) Material conditions including demographic factors, housing, sanitation, transport, labour conditions, instruments of production etc. 3) Ideological factors. The living conditions of human kind is seen as a synthesis of all three aspects.

Although Nature exists independent of man, physical conditions as they appear to us are mediated by human labour. Man and Nature enter into an interdependent relationship. Natural conditions of labour become his mode of inorganic existence. The conditions that contribute to the shaping of human labour have a two-fold character, his subjective conditions which form his actual living conditions as a member of society, family etc., and objective conditions, the physical and biological systems with which he produces and reproduces. What we call environment is the ensemble of subjective and objective conditions of human labour.

Seen from this point of view, environment is the creation of man's historical activity or what has been called "metabolism between man and nature". This is entirely different from the conception of some ecology groups that environment is invariable and eternal. It has to change with history, even as the process of production and distribution changes. In capitalist society, the separation of the worker from his instruments of labour also implies separation from his inorganic existence, from his objective environment. The objective physical

conditions of labour are being controlled by the capitalist, who mercilessly exploits it to enhance his profits. The logic of capitalist accumulation is thus directly responsible for the degradation of the subjective living conditions of the people as well as that of physical and biological environment. During twentieth century, this exploitation reached an unprecedented level because of two wars, conditions of arms race and the technological revolution. These factors resulted in a crisis in the interdependence of man and nature itself and has created panic even in the minds of capitalists.

The current environmental crisis is not the result of abstract man's exploitation of abstract 'nature' because the metabolism between man and nature is the force that had shaped history. It also does not mean that Man's exploitation of nature should cease as has been argued by the idealist 'ecology' groups. The subjective and objective conditions of human labour, should be directly controlled by the labouring men themselves. An environmentalist cannot oppose developmental projects per se, and rule out transformation of nature into forms that can be used by man. He would argue for the rational forms of transformation of nature. Creation of useful products from nature should become a precondtion for the creation of further useful products, which is the essential ingredient of labour process. If this essential condition is not satisfied, transformation of nature becomes destructive and will eventually eliminate the growth of labour power itself.

In concrete terms this means that any development project should satisfy three requirements; a) that the project will sustain the physical and biological conditions of labour b) the project will sustain subjective 'living conditions of the people' associated with it either directly or indirectly, c) If any aspect of the project results in the transformation of the conditions mentioned above, it should be possible to reduce the negative effects of the transformation and provide adequate safeguards by the creation of other useful products that will sustain the objective and subjective conditions of labour. All this means that constructive planning, social cost benefit analysis of the proposed project and fixing of priorities in favour of the masses should precede the planning of every development projects. In capitalist planning, fixing of priorities are inverted in the interests of the capitalist rather than the producer. This inversion of priorities is at the root of the environmental crisis within the capitalist system.

Some environmental groups regard the growth of science and technology itself as the culprit for the environmental crisis. They argue for the development of alternative, "humane" forms of science

and technology as the solution. This argument obscures the real character of the use of science and technology. Science involves theoretical knowledge of the laws of nature which is being transformed into use value and technology, the practical devices for transforming nature. Since the capitalist controls the objective and subjective conditions of labour, science and technology develops based on his priorities. The capitalist uses science and technology as a means of furthering economic exploitation, a weapon of destruction and a mode of increasing his world domination. The task of the environmentalist is not to seek alternative forms of "Indian Science and Technology", but to resist anti-people uses of science and technology, and to use and develop the existing scientific knowledge in sustaining and developing the living conditions of the people. Rational, planned use of science and technology is an integral aspect of every environmental programme. Scientific research should be reoriented to seek answers to the problems of human existence and labour activity.

The destructive use of science and technology has never been manifested more clearly than during the two world wars, and the frightening destructive potentials of the weapons accumulated and used by several developed countries in the post-war period. Many environmentalist groups do not see the gravity of the threat to the future of humankind posed by the protagonists of war. A genuine environmentalist movement, fighting for bettering the living conditions of the people, has also to join the fight for world peace and the peaceful use of science and technology.

Evaluation of KSSP's Experience

KSSP has been taking up environmental issues for nearly two decades. Hence it is instructed to provide a critical evaluation of two environmental issues in which KSSP intervened, which have gained wide attention and generated a lot of debate[18].

Kerala is a narrow strip of land 550 km long and 70 km wide on an average, bounded by the Western Ghats, with ranges upto 2600 m, on the eastern side and the Arabian sea on the Western side. It has a highly undulating terrain. The coastal plains are only 5-10 km in width. Only 15-20% of the total area can be called as plains. This topography has given Kerala its characteristic ecology, habitation patten and agriculture. Western Ghats and the forests thereon play a very prominent role in the economic life of the people of the state. Kerala is blessed with abundant rainfalls, about 3000 mm per year. It is concentrated in 4-5 months of the year. Since the land surface is highly sloping, much of the water finds its way back to Arabian

sea before being utilised for any useful purpose. Here in lies the extreme importance of the vegetative cover forests on the western ghats. 41 rivers emanate form Western ghats and flow into the Arabian Sea. They play a significant role in the state's economy, especially the four major rivers. Kerala's economy is clearly dependent on its hydrology.

Kerala, with its long history of radical political movements, was the first state to complete land reforms. Almost all the citizens own a certain amount of land. The complete destitution that can be seen elsewhere in India, is absent in Kerala. Agriculture is predominantly cash crop based and Kerala has a foodgrain deficit of more than 50%. The density of population is very high about 700 per sq.km. Per capita arable land available is only about 0.08 ha. Intensity of cropping is already very high. Kerala is also an industrially backward state, with a substantial tertiary sector. Remittances from Gulf countries play an important role in the economy and social life of this state.

Kerala has a high level of literacy, about 70%, even amongst women. It has achieved 100% enrolment in primary stage, and has a very low drop-oup rate - tending to zero - in the first four years. Kerala has a history of radical cultural movements, and its political consiousness is very high. Newspapers are widely read and people keep abreast of all national and international issues, discuss and debate them. Unemployment is also very high, especially among educated youth. Both primary and tertiary sectors are already overflowing, so also the traditional industries.

Kerala was subject to wide scale deforestation from the colonial period which has been intensified during the post independence period due to increasing exploitation of forest resources, search for cultivable lands and demographic pressure. Water resources in Kerala was used for hydel and irrigation projects and justifiably so. However, the infrastructure, such as roads, developed for these projects came to be used for illegal and destructive exploitation of forests. The industries that developed in Kerala were mainly agro-processing industries, the other industries in the modern sector being chemical industry, and wood and pulp industry.

Absence of concreate perspective planning at the state level, and the capitalist planning strategies of the Central Government, created a number of difficulties, one among them being degradaion of the environment. Deforestation, soil erosion, pollution from chemical wastes etc. affected the ecology of Kerala. Although Kerala remained an industrially backward state, some of the problems of industrialisation began to affect the living conditions of the people of Kerala.

It is in this context that the environmental awareness of the people of Kerala began to grow. The background to this was provided by a) growth of radical worker's and peasant's movements b) growth of living standards of the people including education, health care etc. c) growth of scientific consciousness generated among the people by radical movements and social protest movements. An organisation for the popularisation of science like the KSSP grew up as a finer product of this consciousness. Socially and politically, conscious groups and individuals began to raise questions regarding environmental degradation.

Silent Valley Project[19]

Silent Valley Project was intended to produce 520 million units of energy annually (with 120 MW) and irrigate about 10,000 hectares of land. A reservoir was to be formed by impounding River Kunthippuzha, a tributary of Bharatapuzha. Within the Silent Valley forests, water was to be dropped to Chathamangalam by 900 meters, which was the largest head of all the power stations in Kerala. Initially two, and later two more units of 60 MW generator was to be installed. The tailrace water would be led into the irrigation canals.

The area of the project lies in Malabar, a backward region in Kerala itself. The average energy consumption of Malabar, which terms nearly 40% of Kerala, is less than one-third of the average energy consumption of the whole of Kerala. There is an immediate demand for energy in the area. Undervoltage is a permanent feature. All the existing power stations except a small one at kuttinad are far away. This project has been the dream of the people of Malabar, for the past 30 years. It was cleared for construction in 1973. Paucity of funds delayed the beginning of the construction to 1976. By that time ecological issues had already cropped up. The NCEPC (National Committee on Environmental Protection and Co-ordination) had already raised objections to the project. Scientists of the KFRI, Zoological Survey of India, Botanical Survey of India, Geological Survey of India etc. had become interested in the ecological importance of the Silent Valley forests. KSSP joined the issue in 1978. It mounted an intense public education campaign about the richness of the Silent Valley forests and the importance of preserving the area in particular and environment in general. Soon the issue caught popular attention and became the major point of discussion and debate everywhere. A popular movement developed on the question of preserving Silent Valley forests, which demonstrated the environmental awareness of the Kerala people. Heeding to the advice of many scientists and scientific bodies, and backed up by the massive

protection movement, the then Prime Minister of India Smt. Indira Gandhi finally ordered to stop the project. The Silent Valley area was declared as a protected biosphere.

What were the grounds on which KSSP opposed the Project? KSSP studied the various reports prepared by experts in the field and based on them as well as direct investigations by its scientists, came to the following assessment:

1) Silent Valley is one of the biologically richest, oldest, the least disturbed and the largest continuous stretches of forests in the Western Ghats that could be protected. Its floristic compositions are complex and is a gene pool of immense utility for the future. It is the habitat of at least three endangered species of animals including the lion-tailed Macaque, the second most threatened primate in the world.
2) The construction of the dam would submerge 830 hectares of reserve forest including the invaluable riparian ecosystem. The interaction problems can have a cascading effect resulting in irreparable damage to the eco-system. No safeguards can prevent these adverse consequences. The experience of the consequence of hydro electric projects on the forests in Kerala did not give cause for any optimism in this regard.
3) The significance of the power generated by the SVHEP, either in relation to the overall energy position of Kerala or sourthern grid, both in the long and short run can only be marginal. The energy requirements of Kerala will mount to about 22000 million units per year by the end of 20th century. The share of the Silent Valley Project will be just 520 million units. The total production of all the Hydel projects in Kerala will not be more than 11000 million units, even by assuming that all of them will be completed by them. Hence it is important that Kerala diversify its energy sources. A thermal plant with its short gestation period and the fillip it would provide to industries requiring energy will be an ideal alternative to the Silent Valley Project. Even other hydel projects can be considered. The urgent requirements of the energy deficient Malabar region can be satisfied by utilising the electricity that was being sent to Karnataka for which a 220 KV receiving station could be completed within one or two years.

Based on this assessment, KSSP came forward with a resolution adopted by its executive committee in October '78. The resolution states that:

i) There exists a live need for additional electrical power for northern kerala

ii) The Silent Valley hydroelelctric project can be of some immediate help to ease the situation.

iii) Silent Valley Project area is a rare forest rich in unique flora and fauna. A large number of scientists have raised their doubts about the advisability of any human action which will destroy this flora and fauna and may, in the long run, cause considerable ecological damage to the area.

iv) Kerala has a cent percent hydro energy system with a high degree of vulnerability towards monsoon failures. Experts in energy planning have pointed out the utmost importance of having a few thermal stations in the system. Under these circumstances the Kerala Sastra Sahitya Parishad requests:

a) That the Central Government may provide for a 200 MW (initially) thermal station in Central Malabar area during the sixth plan itself and

b) That no steps which may cause irreversible changes in the Silent Valley Project area shall be taken before the different possible alternatives are studied in detail and proper decisions are arrived at.

KSSP also pointed out that a social cost-benefit analysis was not undertaken when the project was formulated. Only the technical aspects of the projects were studied, and the results of the study were limited to the availability of water, and the lands that could be irrigated. There were doubts that the estimates given by authorities on the irrigational capability of the project were exaggerated.

It is clear from the above description that the issues raised by KSSP were those affecting the objective physical environment and life forms which were related to the living conditions of the people in that region. It raised questions regarding priorities of planning and the necessity of a cost-benefit estimate which will include the cost of environmental changes also. Interestingly, the demand for thermal power stations raised by KSSP as early as 1975 itself, is now being accepted, although belatedly by the Kerala State Electricity Board and the Government.

The Silent valley issue has brought into sharp focus several issues now hotly debated (1) The question of constructive regional planning, cost-benefit analysis and fixing of priorities while taking up any developmental project, (2) The fact that any developmental project is not a technical matter alone, but it has socio-political and ecological dimensions, which directly affect the living conditions of the people; (3) It also raised the question of adoption of development strategies that will answer the protection of environment and improve

the living conditions of the people. KSSP also maintained that a study of the objective environmental conditions and the living conditions of the people affected by the project should be taken into account before deciding on any development project.

Chaliyar river Pollution[20]

Chaliyar is a river in Malabar, on the banks of which the Gwalior Rayons Factory at Mavoor is situated. This facory, owned by the Birlas, was opened there as a result of the intensive efforts by the Kerala Government in 1957, and it was hoped that the factory would facilitate the growth of the Malabar region. Before long, the hazardous waste from the factory was polluting the river, which in turn affected the productivity of the nereby regions and living conditions of the people there. Popular resentment against pollution was growing. KSSP experts made a detailed study of the problems and showed that it was possible to run the factory with adequate safeguards against pollution. The management itself was responsible for blocking such a solution. It was able to expose the falsehood of the management positions by undertaking a campaign that used a variety of non-formal education methods, by which the people were made aware of the causes of pollution and the methods of pollution control. The campaign made it poossible to build a wide popular front of people in various nearby localities and workers against the management. Mounting popular pressure forced the management to install a purification plant at the factory.

However, the problems faced by the workers of the Gwalior Rayons factory and the people of nearby localities are far from being resolved. The factory was already facing shortage of raw materials which was a result of the denudation of forests. The factory management has been looking for easy profit which they tried to obtain by pressurizing the Government to sell raw materials at a very low cost, blackmailing the workers by constant threats and actual closure of the factory. The management also refused to replace the outmoded machinery which has prevented the factory from functioning at full capacity. The management has also acquired a licence to import pulp at a very low cost from abroad. The functioning of the factory management demonstrates the scant regard that capitalists have towards developmental priorities of a particular region, and the subjugation of basic human requirements to the drive for profit accumulation. Although reopened after a prolonged closure, the functioning of the factory is still replete with problems that can affect the living conditions of the workers and the ecology of Malabar region.

The positions taken by the KSSP have been under attack from two quarters. One section can be called "mechanical developmentalists" who argue that any form of development project should be accepted in toto and problems like environmental degradation and pollution are inevitable consequences of man's exploitation of nature. This amounts to wishing away, the environmental issues and adopting a "consumerist" attitude to nature, and justifying, on the pretext of "development" the inhuman conditions in which the downtrodden millions have been forced to live, as well as the capitalist exploitation of natural resources to the detriment of the laboring population. This also amounts to wishing away the anti-people uses of science and technology by developed capitalism, which is becoming increasingly apparent everyday. Mechanical developmentalistis do not accept the principles of rational use of science and technology, fixing the developmental priorities or cost-benefit analysis of projects, and justify this in terms of "needs of the common man". They overlook the fact that, the very same common man is also the vicitim of anti-people "Developmental" strategies. They are worshippers of large industry and reject planning strategies that incorporates viable use of small industry. For them only "the large is beautiful".

The other attack comes from a section who can be called "Naturalists". They tend to negate the entire progress of science and technology. They do not accept the historical development of Man-Nature relation and coin the slogan "back to nature". They accuse science and technology of being anti-people in content and talk in terms of alternate science and technology. Naturalism is romantic and a historical, and ends up playing a reactionary role, trying to put the clock back, playing into the hands of different shades of revivalism.

KSSP attempted to integrate environmental issues into the developmental perspective. All forms of developmental strategies will have to be examined from the subjective and objective conditions of human labour. India will have to adopt planning strategies that would ensure the rational use of science and technology, minimization of the creation of hazardous wastes, rational use of the physical environment and bio-forms and improve the living conditions of the destitute millions. Such a planning strategy can only be devised by people imbued by scientific consciousness and commitment to the upliftment of the society as a whole. It is this feature that has distinguished the positions of the KSSP from mechanical developmentalists and naturalists.

CONCLUSION :

Environmental problems have to be seen in relation to the development of world capitalism, which is characterised by depletion of natural resources, degradation of the physical and biological environment and the living conditions of the people. Even the socialist countries, despite their better living conditions, are not free from the threat of environment. However, it is clear that any plea for the protection of environment has to be made from the analysis of man-nature relations and development strategies. Developmental strategies and the use of science and technology are being designed to benefit the few against the majority of the people, particularly the labouring classes. Fight against such policies can be intensified only by developing scientific consciousness among millions of downtrodden people who are victims of exploitation and degradation of living conditions. This awareness will have to incorporate a scientific perspective of the environmental problems. KSSP, as a people's science organisation has been striving towards such a perspective, from its own experience and analysis of environmental issues. It does not mean that the perspective developed by KSSP, and the actions initiated by it, are free from mistakes. KSSP has never swerved from its basic commitment to the liberation of the exploited and the impoverished, and its organisational task to spread scientific consciousness among people.

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This paper was presented in the second All India People's Science Congress as the Theme Paper on environment, by the Kerela Shastra Sahitya Parishad. The KSSP has won international recognition for its role in environmental protection and has won the Indira Gandhi award for environment in 1989. Its views on environmental questions are therefore of special interest to all.

CONSERVATION OF OUR ENVIRONMENT

By Dr.V.M.MEHERHOMJI

The conservation movement has gathered such momentum that the very term conservation meaning preservation (which can be applied to many things) is now linked in the public mind with the protection of nature and the multitude of life-forms existing on our planet, Earth. The strong tradition of the Indians of respecting all forms of life was once well known. In the Sacred Groves, the trees are protected with religious fervour. An excellent example of such a Sacred Grove in our Pondicherry region is the one at Puttupet where an un-reserved forest thrives in the midst of fields and villages thanks to the presence of a temple and a sacred "puttu" (ant-hill) inside the forest.

However, to-day very scant respect is left for the denizens of the forests, both trees and animals. With the exploding human population and increasing human needs for more and more space for settlements, agriculture, industries, the result is drastic reduction of areas under forest, grassland and marshes. It is estimated that 50 acres of natural and semi-natural habitats are destroyed every minute. Eleven million ha of tropical moist forests are felled every year. The dependence on wood as source of fuel has also to be reckoned with. Almost 70 per cent of our rural population and 45 per cent of the urban population make use of firewood for cooking.

In the western countries the population growth has been stabilised but not before causing irrepairable demage to the natural resources. Most of their natural wealth was destroyed in the last few centuries. We in India still have a chance of recuperating our natural assets.

The development had been a one-way traffic ignoring the environment till very recently but now it has been realised that development and conservation can go hand in hand, "Development without destruction" is the message put forward by organisations like the International Union For Conservation of Nature and Natural Resources, headed by an eminent Indian Scientist, Dr. M.S.Swaminathan.

The World Conservation Strategy, which was launched by several countries, including India, in March 1980, provides the guidelines for the conservation of the planet's natural resources. Its three main principles are :

— Preservation of ecosystems;
— Maintenance of genetic diversity;
— Sustainable use of natural resources.

It is important to note that conservation does not mean the sort of protection which prevents utilization of natural resources on a sustained yield basis.

The discipline associated with conservation is Ecology. If any individual animal or plant is to be saved we must save the entire complex of life around it as well as the habitat around it.

This is known as the ecosystem, and the principal concern of conservationalists and ecologists is to identify the various ecosystems of the country and to ensure that they are protected against damage of any kind. That any form of life cannot be protected in isolation was well proved in the case of tiger. If the population of tiger had to be saved from extinction, the animals like the deer and wild boar on which prey the tigers had also to be protected. There had to be adequate grasses for the survival of the deer. Therefore, the entire forest ecosystem had to be thoroughly protected to increase the number of tigers.

Plants produce their own food using water, minerals, carbon dioxide and sunlight. Animals live on the food produced by plants. Thus plants are autotrophs or primary producers. Animals are heterotrophs or consumers, or secondary producers. Bacteria and Fungi decompose the dead material, using these as their food. In the process they break down the complex organic compounds into minerals and return these to the soil. They are decomposers.

There is some sort of relationship between the numbers, biomass and energy contents of the primary producers, consumers of the first, second and third orders in any ecosystem. These relationships are represented in diagrammatic ways and are referred to as ecological pyramids. The process of eating and being eaten forms a food chain - the food chain which can always be traced back to the producers.

The food chain in an ecosystem is very delicately balanced and disturbance at any one stage upsets the delicate balance. If birds of prey like kites, hawks and eagles are reduced in numbers, then snakes would multiply and their population would increase in the absence of their natural enemies to control them. In turn the population of frogs would decrease and insect pests would increase demaging the crops.

If snakes are destroyed in large number for their skin, then mice and rats would proliferate. Import of frog legs has resulted in increasing population of insects and reduction in crop yield.

The disappearance of one species could bring about the extinction of 6 to 7 species. A well-known example is that of the Dodo bird which was endemic to the Mauritius Island. Its flesh was

in great demand as a prized food item by the European settlers in Mauritius in the 16th - 17th century. So, Dodo's doom was sealed. The last living bird was reported in 1681, leaving behind the proverb "Dead as Dodo". This, however, is not the end of the Dodo story. A beautiful tree called Calvaria got involved in a fatal link with the dodo. The thick-hulled seeds of Calvaria tree would germinate only after being crushed in the gizzards of the dodos. The disappearance of the bird resulted in a drastic decline of the tree population and to-day only 13 plants survive in Mauritius.

Every species has a particular role to play in the ecosystem and ecologists are trying to understand their importance. The crocodile living in the water of the Ganga, the Gangetic Ghariyal, with its ferocious look was mistakenly thought to be competing with the fishermen. Only after its number was drastically reduced that it was realised that it played a very beneficial role in destroying either the predator fishes or consuming the dead organisms and maintaining the purity of the water.

Dr.P.H.Raven of Missouri Botanical Garden has opined that one out of five of world's orgnisms may become extinct during the next 30 to 40 years. According to Prof. Madhav Gadgil some 40 per cent of the estimated 5 to 10 million species of living organisms are now believed to live in tropical forests, and with this habitat undergoing destruction at a rate of 75,000 sp.km. a year, it is feared that we may lose anywhere between half to one and half million species by the year 2000 A.D. While 90 percent of all species of living organisms that have ever lived on the surface of the earth since life originated 3.6 billion years ago are beliieved to have gone extinct, the extinction rates did not exceed one species per year, so that the total number of species existing at any time has seen either steady or gradually on the increase. The current rates of species extinction therefore represent a totally now global phenomenon that will result in a loss of many options for mankind.

About 5 to 8 per cent of the known species of animals and flowering plants occur in India with a land surface of only 2.2 per cent of the world. It is certain that there would be many further additions when the little studied invertebrates and lower plants are better investigated.

As soon as research shows new use of a particular species, sometimes the industry heavily exploits that species, bringing about its near disappearance. The common periwinkle, Vinca rosea, once abundant on the coastal sands of Mahabalipuram -Pondicherry tract and in Coimbatore vanished as soon as the medicinal properpties of

its root - alkaloids were discovered. soon after, another herb belonging to the Ginger family, **Costus specious,** growing in the ground - cover of the deciduous forests came under focus for its steroids. Padmashri Sundarlal Bahuguna reports the recent case of the hornbeam trees. Research revealed that the hornbeam wood was suitable for making shuttles. The result was that a shuttle factory wanted these trees growing in the remote hills of Tehri Garhwal. However, the local inhabitants knew well the value of the hornbeam trees which were preventing landslides and providing fodder for the cattle during the scarcity seasons, for which purpose they had been protected.

It would be a wise and far-sighted policy to conserve the living natural resources around us. Each species is potentially important as it enriches the biological materials and genetic diversity available to us for our material betterment. There are numerous instances of obscure species becoming immensely important. Two examples may be cited, one is of the diesel like substance yielding Euphorbiaceaus tree - **Copaeifera langsdorfii** - of tropical America and the other is of the Caribbean sponge **(Tethys erupta)** which yields a compound, reported to be extremely beneficial in the treatment of virus diseases particularly of encephalitis, and which is also an inhibitor of cancer.

Plants have been one of the most useful resources available to man from the earliest time to nourish him, to clothe him, to provide shelter for him, to cure him from diseases etc. More and more uses are revealed even currently. Search is on for the plants that may prove a substitute for petroleum. A humble thicket near Pondicherry harbours a leguminous climber **Elumboti - Ormocarpum sennoides,** which is extremely efficacious in mending bone fractures but at present its use is known only to a handful of villagers. The medical world is still unaware of this wonder plant. This thicket which was about to be cleared for raising plantations of Eucalyptus, cashewnut and tapioca was protected through the kind intervention of the Chief Conservator of Forests, Tamil Nadu. Progressive disappearance of forests and thickets would eventually deprive us of plant resources.

History of the earth

Our earth was formed as a planet 5 to 7 billion years ago. If the Precambrian geological period marking the beginning of the earth is 1st January, then the Quaternary period, when man appeared on the earth is 6 p.m. on 31st December.

Life originated in its simplest form 3600 million years ago.

The great ice age of the Permo-Carboniferous period (about 200

to 300 million years ago) laid the foundation of the origin of the land plants.

Flowering plants appeared about 160 million years ago in the Jurassic time.

The cradle where the cone bearing trees like Cycas, Pines and the flowering plants evolved is according to some botanists the Indo-Australian region from where they migrated to other parts of the earth which in the Middle and Late Cretaceous geological period (about 70 million years ago) did not differ much from the present day configuration.

The earth did not have its present shape always. Once upon a time in the very remote past, all the continents were united into a single land mass, the **Pangaea,** which got separated into two parts, the **Laurasia** in the north and the **Gondwana** with South America, Africa, Madagascar, India, Australia and Antarctica in the South. In course of time the earth attained its present day configuration. In course of the geological history, many climatic changes took place. For example, parts of Europe which experience cold temperate climate today had a tropical climate during the Palaeogene about 50 million years ago. This is indicated by the fossils of plants and animals. A dwarf Palm **Nypa** which grows in the Sundarbans and Sri Lanka to-day, has been discovered in form of its fossil fruits in the London clay geological formation.

In short, after a long geological history, every part of earth came to acquire its own particular flora and fauna. Thus are recognised the botanical and the zoological regions of the earth.

It is with the native flora, peculiar to our country or region, that we are concerned to-day.

The species that are very narrowly confined to a small area or region are called **endemic** species. For example, the tree **Albizzia amara** is confined to the Coromandel and Circar coastal plains of Tamil Nadu and Andhra Pradesh. The economically very important timber tree Red Sanders **(Pterocarpus santalinus)** is restricted to the Cuddapah basin and Nalamalai hills of Andhra Pradesh. Other indigenous trees may not to be so narrowly confined to a region. For instance, the teak tree **(Tectona grandis)** also extends to the neighbouring countries like Burma and Thailand.

Because of special means of dispersal, certain species could attain very wide distribution. let us take the case of cocount. The fruit is capable of floating in sea and is carried by sea currents from country to country and has a wide-spread distribution in tropical countries to-day. It is very difficult to say where it actually originated.

Because of the belief that the cocount has been a gift of the sea, it is a custom in India to offer cocount to the sea on special festive occasions. Now unlike cocount, there is another palm called **Lodoicea.** Its fruit is much bigger than that of cocount, and that is why it is called double - cocount but this palm is confined to a few islands like Maldive, Seychelles.

Therefore, some native species have a narrow distribution, others may be wide spread. India with its much diversified climates, harbours about 20,000 flowering plant species. Each climatic zone has its special flora. The Himalayan flora will have hardly anything in common with the Deccan flora. Therefore, the pine growing at relatively lower elevation in the Himalaya, may not be considered indigenous to Madhya Pradesh.

Sometime ago, we read in newspapers that the tribals of Bastar district of Madhya Pradesh were agitated because the forests of indigenous species Sal **(Shorea robusta)** were felled and these were replaced by the exotic pines of the temperate regions. The people living in and around the forest have got used to the native vegetation for their daily needs and it does not make any sense to introduce something from outside the region even though it may be fast growing.

Extension of species by dispersal of its seeds by birds, animals, wind and other agents is a natural phenomenon. But in recent years man has accelerated this process by introducing trees from one country to another on an unprecedented scale, so much so that it is feared in certain quarters that all our indigenous forests would soon make room for the plantations of the controversial **Eucalyptus.**

India harbours at lealst 200,000 species of living organisms. The challenge before us is to conserve this heritage of diversity for generations to come and the time for it is now. For any delay will only mean an irreversible loss of this precious biological heritage (Prof Madhav Gadgil, Pers. Comm.).

While we may save a few hundred, or at most a few thousand of these species in botanical and zoological gardens and in deep freezers, it is clearly impossible to conserve the entire gamut of this tremendous variety through such artificial means. This can only be approached through the conservation of their natural habitats where they live together as members of a community knit together in a web of life.

Only 20 plant species out of nearly 4,50,000 account for at least 85 per cent of the world's food consumption. We have to look for more species of economic importance in the natural ecosystems. At

present there is almost total reliance on a few high yielding varieties of pulses, millets and cereals. On the other hand, natural and even semi-natural habitats harbouring the wild relatives of crops and local varieties are destroyed at an alarming rate of 50 acres a minute. Now the high yielding varieties are not pest resistant unlike the local varieties. Hence conservation of natural and semi-natural habitats like the so called wastelands, road-side (or ruderal) vegetation is a must. They provide local or wild varieties for hybridisation programmes to evolve pest-resistant strains.

Carbon dioxide and global warming

Carbon dioxide is an essential constituent of the atmosphere which influences solar radiation and heat budget of the earth. The gas is essential for photosynthesis and all the carbon existing on our planet has been derived from the carbon dioxide during metabolic activities of the organism.

Any increase in carbon dioxide will result in rise of temperature as it has a "green-house effect"; it does not check the incoming light energy of the sun but it absorbs the infra-red heat wave radiated from the earth's surface and thereby increases the temperature of the atmosphere.

The small amount of carbon dioxide in the atmosphere is the only source of all carbon that passes through the organisms along the food chains. Carbon dioxide on being reduced during the photosynthesis gets incorporated in a variety of organic compounds which form the food of all organisms. During the earth's long history, huge quantities of carbon were incorporated into the tissues of giant plants and animals that once inhabited the earth. However, their death did not result in complete decomposition of all the organic matter but their remains are now available in the form of fossil fuels (coal, petroleum). By burning these fossil fuels man is drawing from the reserves of oxygen in the atmosphere. Carbon dioxide has the unique property of absorbing the infra-red radiation from the earth's surface. While the small quantities of it were helpful in keeping the earth warm, the increased quantities result in rise of temperature.

The two major sinks of carbon dioxide are the ocean and the forests. Forest trees convert CO_2 into biomass through the process of photosynthesis. Forest clearance on a large scale accounts for at least one-fourth increase of CO_2 in the atmosphere according to one view. The oceans play an important role in regulating the carbon dioxide content in the atmosphere, in the form of carbonates.

Increase in methane is also responsible to some extent for the rising temperature. The increased use of chlorofluro carbon in refrigerants and aerosols has resulted in depletion of ozone in polar zones, allowing the entry of ultra violet rays which also lead to warming.

Deforestation

Forests constitute the largest, complex and most important resource. The modern man gets fuel, timber, paper-pulp, raw material for synthetic fibres from the forest.

Forests regulate the earth's temperature regime, water-cycle, control floods and help balance the carbon-dioxide and oxygen in the atmosphere. They check soil erosion.

The natural forests maintain soil fertility by returning the nutrients to the soil through litter.

Man has now cleared forests to have access to more land for agriculture and urbanisation. Forests are removed for timber and fuel. These activities result in recurrent floods, soil erosion, loss of fertility, and at times, in greater incidence of diseases because of loss of organisms which helped in controlling the vectors.

Case may be cited of Kyasanur disease of the Western Ghats in Karnataka. The vector is a species of tick. Once the forests are cleared, the monkeys infected by the tick come in contact with the villagers transmitting the tick, the carrier of a virus. The disease takes a heavy toll of the villagers.

Man has also been replacing the forests by monoculture plantations of single species. These plantations raised for specific purpose as timber, fuelwood, pulp or viscose, do not alleviate the problems but only increase them.

The monocultures drain the soil of specific nutrients. For example, the teak tree requires more calcium thereby depleting Calcium from the soil which gets impoverished. Once the plantation has been cut, the land generally becomes unfit for any other vegetation and fertilizers have to be applied. The monocultures are also susceptible to epidemics. **Eucalyptus** is reported to be withdrawing large quantity of underground water and also removing nutrients in large quantities. On the other hand, its litter is negligible in quantity, does not decompose rapidly and the trees do not support animal life which may bring even small quantity of organic matter to the soil.

Scientific management of forest resources would require plantations of mixed species and recycling of forest products in order to reduce the exploitation of natural forests.

Effects of deforestation on climate

The beneficial effect of forests in decreasing the amount of evaporation from the soil is well-known; bare soil and land covered with whithered plants practically cease to evaporate after a few rainless days, while green-leafed forests continue to transpire for many days depending on the amount of soil water rserved. Trees intercept large amount of rain in their canopy and this is rapidly evaporated back to the atmosphere.

A thick cover of trees reduces wind speed. Rows of trees and shrubs serves as wind-brakes. The mangroves of Sundarbans in Bangladesh used to serve a very useful purpose in shelting the coastal areas during cyclones. The extensive damage caused by cyclones in recent years is partly due to the denudation of the mangrove forests.

Among the most direct and immediate effects of forest clearance are the destruction of the forest micro-climate, the associated changes in albedo, aerodynamic surface roughness, energy balance and water balance.

Charney and his co-workers have emphasized the role of lower albedo (i.e. the proportion of the radiation reflected back to the amount striking a surface) for higher rainfall in a forested region. The albedo of deserts or dry bare soil is considerably greater (30 to 35 per cent) than that of vegetated or forested surfaces (15 to 25 per cent). So the actual net energy imparted to the atmosphere over deserts is less than that over green belts.

Forests act as an obstructing medium under orogrophic rainfall and increase the effective height of land surface in providing an obstruction to air movement. Forests also reduce the wind speed through its aerodynamically rough, undulating canopy.

With the decrease in wind velocity, the air masses are forced to rise. Tall trees with irregular surfaces transpire at rates higher than the calculated potential evapotranspiration rates. Therefore, the potential evapotranspiration rate for a given net radiation will be lower over vegetation types with smoother canopy surface.

Nicholson observed that the Chota Nagpur region which had good area under foreset towards the turn of the century used to receive fairly frequent afternoon showers known as instability rain during summer which favoured tea plantations. Consequent to the destruction of the private forests, inspite of no apparent reduction in the monsoon rainfall, the instability rain has so much decreased that the tea gardens have disappeared.

Meher-Homji compared the trend of rainfall and rainy days for 12 stations of the Western Ghats having undergone large scale deforestation in recent years with 15 stations retaining almost entirely their original forest cover. He found that the former group of stations presented waning tendency in 7 to 11 criteria of rainfall and rainy days against 3 of less criteria of stations having witnessed only negligible deforestation.

Saletti observed that the evergreen forests of the Amazon basin (South America) return as much as 75 per cent of the moisture they receive back to the atmosphere through the process of evapotranspiration to form new rain clouds.

Several questions have been raised about the role forests play in the precipitation cycle. If the forests attract rainfall, why don't the plantations that have been made to replace forests? And again, if evapotranspiring surface of the leaves of the forest maintains humidity in the atmosphere, why don't the lakes that have been artificially created at the expense of the forests? The answer are that the total evapo-transpiring leaf area of a multistoried, dense forest is considerably higher than that of a lake of the same size as the forest. The plants are distributed over several strata in the forest producing an immense total leaf surface which is not the case with the monoculture plantations such as **Eucalyptus** growing in an open formation, or of needle-leaved pines or yet of certain wattles **(Acacia** spp. from Australia) planted extensively in the Nilgiris and Palnis.

Besides, these exotic species unlike the indigenous trees have xoromorphic features to reduce water loss through evapotranspiration. Pines have needle-like leaves; in **Eucalyptus** the leaves are drooping and in some species of wat les **(Australian Acacia)** the leaf stalk (phyllode) takes up the function of leaves, thus considerably reducing the rate of evapotranspiration. Consequently, their role in the water-cycle cannot be compared to the native species which have optimum rate of transpiration. Thus the forests are not just stocks of wood; besides providing timber and a host of economic products of day-to-day use, they are the generators of pure air and stabilisers of soil and water system. The forests modify the local micro-climate to a considerable extent by reducing temperature, raising humidity and making conditions more favourable for rainfall.

The lack of forest and vegetation-cover not merely affects the water regime but it also results in a calamitous loss of the top soil, which is by any reckoning our most precious asset. It has been estimated that 6000 million tons of soil is lost every year through erosion by wind and water in India alone. It is equally pertinent to

remember that one inch of top soil may take as long as 1000 years to build up, and therefore for all practical purposes it is a non-renewable resource.

To quote from the Encyclopaedia of Indian Natural History published by the Bombay Natural History Society, the Conservationists have a significant role to play with regard to agriculture too. To get the highest yields of crops from the soil, man has to resort to heavy applications of chemicals, fertilizers and pesticides. But in many cases, there is overuse of these which results in destruction of many living species which are beneficial to agriculture. Just a square meter of soil may be harbouring hundreds of insects and worms aerating the soil and rendering it highly productive. Organic way of farming, avoiding pesticides and fertilizers provides a solution to maintain natural fabric of life.

This paper was presented as the key-note address on environment in the second All India People's Science Congress. Dr. V.M.Meher Homji is one of India's most qualified and experienced ecologists and internationally renowned as a bioclimatoligist. His considerable research work includes detailed studies of the relationship between forests and rainfall. He works as a scientist in the French Institute in Pondicherry and is currently also Deen, of the Salim Ali School of Ecology in Pondicherry. He is also president of the Pondicherry Science Forum.

HEALTH AND PSM'S

BY DELHI SCIENCE FORUM.

India was a signatory to the "Alma Ata Declaration" adopted by the World Health Assembly in 1978, which gave the call "Health for all by 2000 AD". Today, 10 years after the Alma Ata declaration, the state of health in India makes the country one of the most backward in this respect. The facilities in some of our hospitals may be among the best in the world and the same can be said about our doctors. This, however, does not determine the health of nation. The only true index of a nation's health is the state of health of the vast majority of people, and not that of a privileged few. In this regard the Government's own "Statement on National Health Policy" (1982) states "The hospital based disease, and cure-oriented approach towards the establishment of medical services has provided benefits to the upper crusts of society specially those residing in the urban areas. The proliferation of this approach has been at the cost of providing comprehensive primary health care services to the entire population, whether residing in the urban or the rural areas".

POST-INDEPENDENCE EXPANSION IN HEALTH SERVICES

However this should not detract from the fact that since independence there has been improvement in many areas, both in terms of growth in infrastructure and in terms of their actual impact on the health status of our people. The following table gives an account of the progress made.

Table — 1

IMPROVEMENT IN HEALTH FACILITIES / CONDITIONS SINCE INDEPENDENCE

Year	Life expectancy at birth	Infantmortality rate (per 1000)	No. of hospitals	Population per bed	No.of PHCs	Doctors per lakh popln.
1951	32.1	180	2694	3199	725	16.5
1961	41.2	165	3094	1930	2800	17.6
1971	45.5	137	3976	1673	5112	25.8
1981	52.1	120	6805	1405	5568	38.2
1985	57.0	105	7181	1378	7210	N.A.

Source : Compiled from Govt. sources

It is however important to understand both the content and the process involved ino this progress made in the health sector. There is a tendency to cite the above figures to make out a case for positing that this progress has been adequate, and hence no major policy interventions are necessary. The health services at the time of Independence were a function of the socio-economic and political interests of the colonial rulers. Consequently they were highly centralised, urban-oriented and catered to a small fraction of the population. Public health services were provided only in times of outbreaks of epidemic diseases like small pox, plague, cholera etc. The post -independence era witnessed a real effort at providing comprehensive health care, and in extending the infrastructure of health service.

Even the West went through this rapid phase of improvement of health services, after a period of stagnation, at the turn of the century. In the early days of the Industrial Revolution the bulk of workers who came to work in factories from the countryside suffered from malnutrition, communicable diseases and high rates of infant and maternal mortality. When it was realised that the very suffering of the people was endangering industrial production (and thereby profits), active steps were taken to dramatically improve public health services. Economists who had considered medical expenditure as a mere consumption item, realised that allocation on health care was actually an investment on increasing productivity of labour. Another major thrust was provided in the aftermath of the Second World War, when with the rise of organised workingclass movements and the consequent development of democratic consciousness in many European countries the concept of "Welfare States" was mooted. For example the National Health Scheme in Britain, which is highly regarded even today, took shape under the Labour Government just after World War II. A rough analogy can be drawn with this and the Indian situation after Independence. Consequent to the transfer of power in 1947, the character, and as a result the long term interests, of the ruling sections changed and consequently their interests and motivations were qualitatively different from that of the British. Their own interests required a major thrust towards building of an infrastructure to provide some basic facilities to the people. This thrust was both an expression of the need felt by the ruling sections to rapidly increase the industrial base and agricultural production, and a consequence of the concessions they required to make towards the genuine aspirations of the people. This basic difference between colonial India and free India, albeit under an exploitative social system, should be understood.

At the same time major scientific discoveries revolutionised the treatment and prevention of many diseases. These have contributed greatly to the increase in life expectancy and in reduction of mortality. The antibiotic era has made it possible to control a larger number of infectious diseases, for which no cure was earlier possible. Rapid strides have been made in the fields of immunisation, diagnostics, anaesthesia, surgical techniques and pharmaceuticals. This has had a dramatic impact on mortality and morbidity rates all over the world. There are pitfalls of an absolute dependence on technological solutions to health problems, but it is definitely true that in many instances new technologies have had a major impact. However the improvements in our health delivery system have not kept pace with the needs of a vast majority of our people. So much so that the Government's "Statement on National Health Policy" (1982) is forced to state "In spite of such impressive progress, the demographic and health picture of the country still constitutues a cause for serious and urgent concern".

BALANCE SHEET OF HEALTH

The following statistics give a picture of the state of health of our people :

— Only 20% of our people have access to modern medicine.

— 84% of health care costs is paid for privately.

— 40% of our child suffer from malnutrition. Even when the foodgrain production in India increased from 82 million tonnes in 1961 to 124 million tonnes in 1983, the per capita intake decreased from 400 gms. of cereals and 69 gms. of pulses to 392 gms. and 38 gms. respectively. Due to increasing economic burden on a majority of the people, they just cannot buy the food that is theoretically "available".

— Of the 23 million children born every year, 2.5 million die within the first year. Of the rest, one out of nine dies before the age of five and four out of ten suffer from malnutrition.

— 75% of all the diseases in India are due to malnutrition, contaminated water and non-immunization.

— Only 33% of deliveries are attended to by trained people.

— Life expectancy is 57 years. This is less than even that in many Third World Countries like Nicaragua, Brazil, Vietnam, Burma, Peru etc.

— 50% of children and 65% of women suffer from iron deficiency, anaemia.

— Only 25% of children are covered by the immunization

programme. 1.3 million children die of diseases which could have been prevented by immunization.

— 1/3 of the total population of India is exposed to Malaria, Filaria and Kalazar every year.

— 550,000 people die of TB every year. About 900,000 people get infected by Tuberculosis every year.

— About half a million people are affected with leprosy, which is 1/3 of the total number of leprosy patients in the world.

— 70% of children are affected by some intestinal worm infestation.

— 1.5 million children die due to diarrhoea every year.

A comparison of Infant Mortality Rates (i.e. number of deaths under the age of one month per thousand live births) of some countries in 1960 and 1985 shows that many countries with a poorer or comparable record 20 years back are today much ahead of India.

TABLE - 2

Country	IMR in 1960	IMR in 1985
Turkey	190	84
Egypt	179	93
Algeria	168	81
India	165	105
Vietnam	160	72
China	150	36
UAE	145	35
El Salvador	142	65
Jordan	135	49

Sources: 'State of the World's Children' 1987 - UNICEF

INADEQUATE RESOURCE ALLOCATION

One of the principal reasons for the state of health of our people, lies in our wrong priorities as far as resource allocation is concerned. This is borne out by the following table which shows progressive reduction in budgetary allocation for Health in successive Five Year Plans (not inclusive of allocation for Family Welfare):

TABLE - 3

Plan Period	% share of Health Budget
1951-56	3.32
1956-61	3.01
1961-66	2.63
1966-69	2.11

Plan Period	% share of Health Budget
1969-74	2.12
1974-79	1.92
1980-85	1.86
1985-90	1.88 (esstimated)

Source: GOI, Health Statistics of India, 1984.

The government spends just Rs.3/- per capita every month on Health. (This may be contrasted with the estimated average expenditure, incurred privately, of Rs.15/- per capita every month) The following table gives a comparison of the percentage of govt. allocation on health.

TABLE - 4

Country	% of central govt. expenditure allocated to health (1983)
India	2.4
Egypt	2.8
Bolivia	3.1
Zaire	3.2
Iran	5.7
Zimbabwe	6.1
Kenya	7.0
Brazil	7.3
Switzerland	13.4
FRG	18.6

Source: The state of the World's Children-1987.

Moreover, even these meager resources are not equitably distributed. 80% of the resources is spent on big hospitals and research institutions which are situated in metropolitan cities and large urban centres. They cater to less than 20% of the people. On the other hand just 20% of the resources is spent on primary health care, which caters to over 80% of the people. The following table gives the comparative figures of hospitals and beds in rural and urban areas.

TABLE - 5

COMPARISON OF NO. OF HOSPITAL BEDS IN RURAL AND URBAN AREAS (As on 1.1.1984)

	No. of Hospitals	% of total	No. of Beds	% of total
Rural	1894	26.37%	68233	13.63%
Urban	5287	73.63%	432395	86.37%
Total	7181	100.00%	500628	100.00%

Source: Health Status of The Indian People, FRCH, 1987.

Of the total number (just over 2 lakhs) of allopathic physicians in the country, 72% are in urban areas. Further, only 15.25% of all health personnel work in the rural primary health sector of the government. As a result of the highly inadequate Govt. intervention in the health sector people are forced to take recourse to the private sector in health care. By this kind of an approach, health has been converted to a commodity to be purchased in the market. Only those who can afford it can avail of the existing health facilities. It is thus clear that health is perceived by the Govt. as a low priority area with grossly inadequate resource allocation, and a skewed pattern of utilisation of these meager resources. This is a fundamental problem in the health sector which calls for rethinking regarding the whole developmental process in this country.

Here another disturbing trend needs to be mentioned. In the last few years there has been large scale investment by the private sector on curative services. With encouragement from the government, for the first time in India big business houses are entering the field of health care. In addition to the fact that they are exclusively meant for the elite, the trend is also an indicator of a certain kind of Philosophy within Govt. circles regarding health care. It is the kind of thinking which draws inspiration from a World Bank report which says "present health financing policies in most developing countries need to be substantially reoriented. Strategies favouring public provision of services at little or no fee to users and with little encouragement of risk-sharing have been widely unsuccessful". (de Ferranti, 1985). This, in other words, is a prescription for increased privatisation. The National Health Policy Statement says "With a view to reducing governmental expenditure and fully utilising untapped resources, planned programmes may be devised, related to the local requirements and potentials, to encourage the establishment of practice by private medical professionals, increased investment by non - governmental agencies in establishing curative centres . . .". Is this not tantamount to an abandonment of the Govt.'s duty in providing health care to all. Increased privatisation in health can only serve to exclude the most impoverished sections, pricisely the section who need health services the most! The answer to the Govt.'s inability to find sufficient resources for health programmes certainly cannot lie in taxing the community for provision of health care.

LACK OF HOLISTIC APPROACH

Health services, in the traditional sense, are one of the main but by no means the only factor which influence the health status of the people. Today the concept of social medicine recognises the role of such social and economic factors on health as nutrition, employment,

income distribution, environmental sanitation, water supply, housing etc. The Alma Ata declaration states "health, which is a state of complete physical, mental and social well being, and not merely the absence of disease or infirmity, is a fundamental human right and that the attainment of the highest possible level of health is a most important world-wide social goal whose realisation requires the action of many other social and economic sectors in addition to the health sector". Flowing from this understanding, health is not considered any more a mere function of disease, doctor and drugs. Yet even today the existing public health infrastructure in India is loaded in favour of the curative aspects of health.

For a country like India, it is possible to significantly alter the health status of our people unless preventive and promotive aspects are given due importance. An overwhelming majority of diseases can be prevented by the supply of clean drinking water, by providing adequate nutrition to all, by immunizing children against prevalent diseases, by educating people about common ailments and by providing a clean and hygienic environment. It has been estimated that water-borne diseases like diarrhoea, poliomyeilitis and typhoid account for the loss of 73 million work days every year. The cost in terms of medical treatment and lost production, as a consequence, is estimated to be Rs.900 crores - which is about 50% of the total plan allocation on health!

Yet according to the Govt.'s health policy statement (1982) "Only 31% of the rural population has access to potable water supply and 0.5% enjoys basic sanitation". The situation is not much better in urban slums. A recent study conducted by the National Institute of Health and Family Welfare points out "the existing health and morbidity patterns in the urban slums is even worse than the rural areas of India". Talking about Delhi the study says "the most important and common features in three out of four slums are the extremely insanitary environmental and hygeinic conditions in which the slum population is living". Further, while India accounts for more than 35% (3000 deaths every day) of all deaths taking place in developing countries due to vaccine - preventable diseases, less than 25% of our children are covered by the Expanded Programme of Immunization. How preventive measures can alter the course of diseases is typified by Tuberculosis. Drugs for treating Tuberculosis were discovered after 1940. Yet, 20 years earlier, the disease had been almost totally eradicated from Britain due to improvement in conditions of living. But even today, when numerous drugs have been discovered for treatment of the disease, more than half a million die of it every year in India.

We have seen earlier that resource allocation is heavily biased in favour of urban areas. Similarly the emphasis on curative services also reflects a bias in our planning process in favour of such services vis-a-vis preventive and promotive services. As in other walks of life, health services are a function of the political system of a community. They reflect the needs of the ruling sections, in terms of resource and manpower allocation and in regard to the choice of technology. A holistic approach towards health care, taking into account the socio - economic factors influencing health, demands a level of conciousness which is lacking in our planning process.

PRIMARY HEALTH CARE SYSTEM

The Alma Ata Conference defined Primary Health Care as "essential health care made universally accessible to individuals and acceptable to them through their full participation and at a cost the community and country can afford". This concept was mooted as an alternative to the existing concept of comprehensive health care, which viewed the people as mere receivers of curative services through doctors, health centres, dispensaries and hospitals. It based itself on four broad principles:

1. equitable distribution of health services
2. community involvement
3. multi-sectoral approach
4. appropriate technology

The Rural Health Scheme launched in India in 1977 is seen as the major component in the primary health care system. It is essentially a 3-tier system of health care delivery. The three levels are

1. Village level - includes the Community Health Worker (CHW) scheme and the Integrated Child Development Scheme (ICDS)
2. Sub-centre level - manned by one male and one female Multipurpose worker. Target is to have one sub-centre for every 5000 population.
3. Primary Health Centre Level - has a staff of 3 doctors (One female and two male) and other auxiliary staff. PHCs have facilities for laboratory tests, minor surgical procedures etc. They are also responsible for training of health workers, maintenance of records and for liaising with various National Health Programmes.

While this 3 tier system is supposed to provide basic health care, there are a number of "national health programmes". These cover areas requiring special attention and include areas like Immunisation,

Family Planning, Tuberculosis, Malaria, Leprosy, Blindness, Child health (ICDS programme) etc. These programmes, also known as "Vertical Programmes" are technically not part of the Rural Health Scheme but are organised along independent lines with centrally administered control.

It is widely recognised that both the Rural Health Scheme and the vertical programmes are plagued with problems of inadequate facilities and resources. The annual report of the Ministry of Health and Family Welfare (1987-88) very candidly states "because of the resource constraints only 50% of the Community Health Centres would be established by the year 1990". In other words the targeted coverage of the PHC system by 1990 is just 50%! Similarly is the state of various vertical programmes. The Nutrition Foundation of India in a study of the Integrated Child Development Service (ICDS) says "Though ICDS has been extended to cover more blocks form time to time, the support it has recvieved has been grudging and halting" and often "extracted after much struggle". The CAG report for the year ending March 31, 1987, has criticised the functioning of three major programmes viz. Blindness Control Programme, Tuberculosis control programme and Leprosy eradication programme. These programmes have been pulled up for improper or non utilisation of funds, non release of sanctioned funds and lack of planning and monitoring of these programmes. The principal problem with all the health programmes in operation has been a total lack of community participation and the consequent absence of accountability of these programmes to the local community, which runs counter to the guiding principles of Primary Health Care.

We have dealt earlier with the problem of resource constraints and their inequitable distribution. This has its severest repercussion on the rural health scheme. Even based on Govt. claims the coverage of sub-centres and primary health centres are less than 50% of the total rural population. Where these centres have been set up, they are under staffed and suffer from lack of medicines and equipment.

Another major drawback has been the difficulty in attracting doctors to serve in the rural health scheme. By and large doctors opt to work in rural centres only as a last resort. This reflects on both the quality and motivation of medical personnel manning primary health centres. Unwillingness of doctors to serve in the rural sector is also an indictment of our medical education system. The curriculum is heavily loaded in favour of curative medicince and within this in favour of diseases conforming to the mortality and morbidity profile in the West. During their period of training medical students are

taught to rely on sophisticated diagnostic aids. Such training ensures that medical graduates are ill-equipped to work in conditions prevailing in the rural areas. Moreover the medical profession is invested with an aura of glamour, which unfortunately is seen to be lacking in service in the rural sectors.

It needs also to be understood that entry into medical colleges is by and large limited to those coming from a higher socio - economic strata, predominantly from urban areas, who consequently find it difficult to conceive of working in rural areas. Even when unemployment among doctors is not uncommon, doctors are unwilling to take up jobs in PHCs. A two pronged strategy is required to tackle the situation. Medical curriculum has to be reoriented and entry into medical colleges needs to be regulated in a manner which ensures a more balanced "mix" of students. Side by side incentives have to be worked out to attract doctors to the rural health schemes. After all it is impractical to believe that doctors are naturally fired by altruistic motives and with feelings of "service to the poor". At the same time, within the medical fraternity, there is a strong resistance in changing the age old concept of health as a function of doctors and drugs. Implementation of the recent concept of primary health care requires a certain degree of demystification of Medical Science. But within the established medical bureaucracy and in the entrenched sections of the medical fraternity there is a vested interest in maintaining the status quo. This outmoded position within the medical fraternity needs to be countered.

The interaction of the various "vertical programmes" with the rural health scheme is another area which needs attention. These programmes are all centrally administered with separate administrative controls, staff and budgetary allocations. However all these programmes need to operate through the rural health scheme, but as they have separate administrative controls, they are not accountable to the rural health scheme. As a result there is needless duplication of administrative manpower, costs and often confusion regarding aims. While the basic aim behind the vertical programmes of giving emphasis to problem areas is laudable, they need to be administratively integrated with the rural health scheme. Otherwise they will continue to work at cross purposes with the rural health scheme, often at great cost to the available material and human resources.

COMMUNITY PARTICIPATION

The slogan "Peoples' health in people' hands" has today received universal support. Diverse agencies cutting across all kinds of ideological positions accept that community participation is vital to the sustenance of any comprehensive health programme. The Govt.'s Statement on Health Policy also recognises this postion while stating "Also, over the years, the planning process has become largely oblivious of the fact that the ultimate goal of achieving a satisfactory health status for all our people cannot be secured without involving the community in the identification of their health needs and priorities as well as in the implementation and management of the various health and related programmes". Unfortunately there is a basic lack of clarity on the concept of community participation. Often, especially in official circles, it is taken to imply that the community participates in collectively receiving health services! A strategy developed by the Govt. to bring about community participation is the Community Health Worker (CHW) scheme. The scheme involves recruitment and traning of a Community Health Worker from every village community. The CHW is required to interact with the PHC system on behalf of the village community he represents. The scheme was introduced in 1977, as part of the Govt.'s Rural Health Scheme, based on the recommendations of the Srivastava Committee (1975). The guidelines for the selection of candidates for the CHW scheme are:

1) They should be permanent residents of the local community, preferably women. (in 1981 it was recommended that all future CHWs selected should be women so that the pressing tasks of maternal and child health may be seen to)
2) minimum formal education upto VIth standard
3) should be acceptable to all sections of the community
4) should be able to spare at least 2-3 hours every day for 'Community Health' work.

Candidates after selection are trained for a period of a 3 months. After completion of their training the CHWs are given an honorarium of Rs.50 and simple medicines worth Rs.50 per month. They are free to continue in their earlier vocation, but are expected to devote 2-3 hours every day to community health work.

As the CHW scheme constitutes the Government's principal effort in implementing the slogan of "Peoples' health in peoples' hands" it merits a closer look. Under this scheme around 4 lakh

CHWs have been trained. However the implementation and impact of the scheme raises a number of questions related to the whole concept of community participation.

The CHWs scheme presupposes a degree of volunteerism in the selected candidates. Otherwise a stipend of Rs.50 per month is far short of an adequate remuneration for the CHWs whose functions include - health education regarding preventive and promotive measures; encouraging participation of the community in public health tasks; curative measures for treating simple disorders and referrals to the next level (sub - centre). In other words the CHW is also required to play a leadership role in the community. However the methodology required to identify such persons is yet to be worked out. In practice the contradiction between inadequate remuneration and high expectations is often resolved in one of two ways. Either, after a short period of CHW stops performing the required functions or drops out of the scheme altogether. Or he sets himself up as a private practicioner in the village. (In should be realised that the training imparted to them is often more than what a large section of unqualified practitioners/quacks in villages have received.)

Moreover, while the CHW's main functions are related to promotive and preventive aspects, the village community almost invariably is more interested in his curative abilities. Thus the CHW ends up as another practitioner in the village, albeit with partial Government support. The training programmes of CHWs are also not flexible enough to take into account regional and caste/community based differences in perceptions towards health. Thus a dichotomy exists between the CHW's own perceptions (with are usually closer to those of his community) and those imparted from "above" during the training programme.

Another misconception has been to view the rural communities as homogeneous units. As a result there is no clear vision regarding how community participation can be ensured in vast tracts of rural India which is divided on the lines of class, caste and religion. The tendency is to solicit support for any health programme from the village "sarpanch" or other influential members of the village which in most areas means the "high" caste and landed sections. A similar modus operandi is applied while choosing the CHW "acceptable to all sections" from the village community. This almost invariably means excluding the landless and poor peasants, who form a bulk of the population and are most in need of health services, from the decision making process.

The deficiencies enumerated above in CHW scheme are questions which require to be faced squarely if community participation is to be the desired goal. Central to the problem is the question of acceptance by our village communities of the concept of preventive medicine. Today attempts at introducing this concept are carried out by initially gaining entry through curative services. In other words curative services are offered as the "carrot" to ensure acceptability of the programme, while preventive services are sought to be introduced through the "back door". Such subterfuge, which starts by not taking the local community into confidence, cannot bring about any significant degree of community participation.

It needs to be recognised that communities are primarily interested in curative services because of the utter inadequacy of these services. As a result this is perceived, and rightly so, as the immediate necessity. Can the people be faulted for such a perception when majority of them are denied access to even very rudimentary curative services. Moreover the functioning of programmes aimed at providing preventive care has not shown to the people the advantages of preventive medicine. It is only when, from their own experience, people realise the advantages of preventive services that one can expect a shift in perception.

Thus to sum up, for any tangible changes to take place in the field of health, radical redemarcation of priorities in the whole health care delivery system have to be initiated. Hard political decisions to greatly increase spending on health care have to be taken. For the Primary Health Care system to function adequately, it has to be made answerable to local bodies. This in turn would require steps to democratise the functioning of the panchayat system and much greater decentralisation of administrative and fiscal powers. In the absense of such measure, one can only hope for some sporadic cosmetic changes to take place.

FAMILY PLANNING

Today urgent rethinking is required on the whole strategy of family planning. Expenditure in this area has increased by leaps and bounds. From a meager 0.14 Crores in the First Plan it went up to 409 Crores in the Fifth Plan, 1426 Crores in the Sixth Plan and finally to a proposed 3256 Crores in the Seventh Plan. Yet the birth rate has remained static at around 33 per 1000, for the last decade. How then is the continued increase in expenditure on family planning to be justified?

Actually the basic problem lies inthe inverted logic that a falling birth rate precedes socio-economic development. The experience in countries all over the world has shown that exactly the reverse is true. The family planning programme as it stands today, is another example of attempting to find technological solutions to social problems which require societal measures. Moreover, the family planning programme with its fetish for targets, places an added burden on the health care delivery network, which it is ill equipped to carry. As a result there is a further whittling down of the already meager relief that the primary health care system provides. As noted in the case of other vertical programmes, the family planning programme too needs to function in an integrated manner with the rural health scheme.

CRISIS IN PHARMACEUTICAL INDUSTRY

Though there continues to be a greater emphasis on the curative aspect of health, even this area is plagued by a variety of problems. This is examplified by the total anarchy which prevails ino the production and supply of medicines. Only 20% of the people have access to modern medicines. There are perennial shortages of essential drugs, while useless and hazardous drugs flourish in the market. There are 60,000 drug formulations in the country, though it is widely accepted that about 250 drugs can take care of 95% of our needs. The market is flooded with useless formulations like tonics, caugh syrups and vitamins while anti-TB drug production is just 35% of the need. While 40,000 children go blind every year due to Vitamin-A Deficiency, Vitamin-A production was just 50% of the target in 1986-87. The production of Chloroquine has shown a decline in recent years, at a time when 20% of the people are exposed to Malaria every year.

Globally the Pharmaceutical Industry, is today, a live topic for discussion. On the one hand new vistas are opened up everyday and new drugs have revolutionised treatment of several diseases. Side by side, increasing concern is being expressed about the harmful consequence of the unbridled growth of the Industry. The turnover of the Pharmaceutical Industry has increased by leaps and bounds and today, globally, it stands next only to the Armaments Industry. The growth of the Industry has been phenomenal in India too. From a turnover of Rs.10 crores in 1947, it rose to Rs.1050 crores in 1975-76 and today stands at Rs.2350 crores.

In spite of the growth in Pharmaceutical production in the country, however, morbidity and mortality profiles for a large number of diseases continue to be distressingly high. It is thus clear that there

is a dichotomy between the actual Health "needs" of the country and drug production. It is also obvious that a mere arithmetic increase in Drug production cannot ensure any significant shift in disease patterns. Hence, if this dichotomy between drug production and disease patterns is to be resolved, some drastic measures are called for to change the pattern.

The Pharmaceutical Industry in India has developed along the lines followed in developed countries. The reasons for this are twofold. First, the Industry in India being in the grip of MNCs, drug production has naturally followed the pattern of production in the parent countries of these MNCs. No attempt has been made to assess to actual needs of the country. Secondly, the India Drug Industry caters principally to the top 20% of our population, who have the purchasing power to buy medicines. This is also the section which is amenable to manipulations by the high power marketing strategies of the drug companies. Moreover, in this section, disease patterns do roughly correspondent to that in developed countries. The industry is thus able to neglect the needs of 80% of the population and yet make substantial profits. It sees no need to change its pattern of drug production and thrust of its marketing strategy. One is unlikely to see any change in these areas unless the Industry is compelled to change by stringent regulatory measures, by the Government.

Further, drugs differ from other consumer goods, in that while the consumers have a direct say in the purchase of consumer goods, such is not the case for drugs. Drugs are purchasecd on the advice of doctors. Even in the case of over the counter sales of drugs, doctors and chemists have role in determining the market needs.

The prescribing habits of doctors are determined initially by the curriculum of medical education and later by information supplied through medical representatives by drug companies. Medical students are trained on the lines, followed in the west, and by and large the curriculum has very limited relevance to the existing situation in the country. On this the report of the Medical Education Committee, Ministry of Health and Family Welfare says, "The present system of medical education has had no real impact on the medical care of the vast majority of the population of India". It is thus not surprising that what doctors prescribe have little relevance to the disease patterns in the country.

What is probably even worse is the fact that doctors, after passing out of teaching institutions, have almost no access to unbiased drug information. As a result their prescribing habits are moulded by

information regularly supplied by drug companies. This information, for obvious reasons, is manipulated to support the production patterns of the drug industry. So ultimately what medicines the patients gets is determined not by his actual needs but by what the drug companies feel are necessary to maximise their profits.

INCORRECT PRIORITIES OF GOVERNMENT

The problem is compounded by the manner in which the government makes estimates for drug requirements. The most important criterion used for this purpose is based on 'market needs'. Given the scenario related above, this can never reflect the actual drug needs of the country. Today, a need is created for various inessential drugs, by sales promotion campaigns conducted by drug companies. Thus for example Vitamins and tonics in large doses are prescribed along with antibiotics. This is a 'created need', though Vitamins and tonics are same of the highest selling products in the market.

India accounts for about 18% of the world's population, manufactures and markets only 2% of the total global drug production, out of which barely 30% are essential, to meet the drug needs to treat 24% of the total global morbidity. The following table gives us some idea of the shortfall in essential drug production. (Though the gravity of the situation is more than what the table indicates, as the demand estimate given for 1982-83 - based on government figures are a gross under estimation. Moreover for 1986-87 the Chemicals Ministry has even stopped giving figures for demand estimates, and supplies only figures for target of production!)

Table - 6

SHORTFALL IN PRODUCTION OF ESSENTIAL DRUGS

Name of Drug	Unit	1982-83 Demand Estimate	1982-83 Total Availability	1986-87 Target Estimate	1986-87 Total Availability
Penicillin	MMU	370	360-32	450	266.64
Streptomycin	T	270	247.87	270	203.88
Chloramphenicol	T	300	111.46	300	71.60
Ampicillin	T	200	142.27	380	158.45
Vitamil-A	MMU	77	52.00	140	69.34
INH (Anti Tubercular)	T	250	288.40	325	188.59
Chloroquine	T	200	194.57	410	177.61
Dapsone (Anti Leprosy)	T	200	86.90	60	25.51
Diptheria Anti Toxin	MU	800	653.57	800	691.05

Source: Indian Drug Statistics, 1984-85 Ministry of Chemicals and Fertilizers, GOI. & Annual Report Department of Chemicals and Petrochemicals, GOI, 1987-88.

The Indian sector in the Pharmaceutical Industry (Including both private and public) has the capability to produce all essential drugs. Yet the multinational sector continues to play a dominant role. The mercenary attitude of drug multinationals is responsible for holding the health of the country to ransom. They market drugs in this country which are banned in their parent countries. They use the country to test new drugs with dangerous side effects and in a variety of ways flout the law of the land with impunity. Health related industry has the second largest turnover, world over, after the armaments industry. Today the predatory nature of the pharmaceuticals industry appears ready to outstrip even the armaments industry. The control of drug multinational companies on the Indian market is almost complete. There are more than 50 MNCs in the drug market in India. Fifteen such companies control as much as 31.8% of the total Indian market. MNCs in the process have earned huge profits while charging exorbitant prices for their products.

There have been persistent demands that the Multinational companies should be nationalised. In fact this was one of the recommendations of the Hathi Committee set up in 1974 to go into the problems of the Pharmaceutical Industry. MNCs are still being allowed to operate in this country on the plea that they bring in new technology. Yet their record in the last decade shows that their contribution in this field has been less than the Small Scale Sector. Today the MNCs reap super-profits by mainly producing inessential drugs. The following table gives an account of the contribution of MNCs in drug production.

Table - 7

COMPARATIVE CONTRIBUTION OF MNCs AND NATIONAL Cos (Top 85 Cos.)

(Rs.in Crores)

Class of Drug	Total Prod.	MNCs(40)	National(45)
ESSENTIAL			
Antibiotics	256.5	82.9 (32.3%)	173.6 (67.7%)
Anti-T.B.	29.2	4.0 (13.7%)	25.2 (86.3%)
Sera-Vaccines	1.5	0.5 (33.3%)	1.0 (66.7%)

INESSENTIAL/ SIMPLE REMEDIES			
Tronics	32.0	20.1 (62.8%)	11.9 (37.2%)
Cough & Cold preparations	55.7	41.4 (74.3%)	14.3 (25.7%)
Rubs & Balms	12.5	12.3 (98.4%)	0.2 1.6%)
Vitamins	98.0	78.8 (80.4%)	19.2 (18.6%)

Source: ORG Retail survey, April 85 to March 86.

The new drug policy announced in December 1986, instead of spelling out measures for control of MNCs has granted them even more concessions. It has allowed increased profitability on drugs and has reduced production controls. The recent trends of import liberalisation and production and price decontrols are in line with the present Governments attitude to industry as a whole. However the drug industry is probably unique in that it has a direct bearing on the lives of almost everyone. The Government has never, while formulating its drug policy, taken into account this uniqueness. As a result, "market forces are being allowed to determine the availability and prices of drugs. In a situation where only one out of five Indians can afford modern medicine, this is tantamount to following a policy which is detrimental to the interests of an overwhelming majority of people.

ROLE OF VOLUNTARY AGENCIES

Probably the single largest contingent of Voluntary agencieis are involved in work in the health sector. Unfortunately the net output of their work has not been commensurate with the extent of their presence. One of the major problems has been the multiplicity of agencies thus involved and their consequence inability to come up with coherent outputs. The diverse ideological and methodological predilections of these agencies have also prevented them from arriving at any kind of unified understanding. Many agencies are dependent on the "quality" of those heading such projects, which ultimately works as a constraint in replication of pioneering efforts in different conditions. Moreover the need to develop models for

replication are not recognised as a priority by most. These problems are often compounded by the multiplicity of funding agencies, each with differing perspectives. This results, at times, in agencies having to modify their outputs to suit the needs of funding agencies.

Compared to Government services the coverage by the Voluntary sector in providing primary health care is negligible and will remain so - indeed, the basic responsibility for health care must rest only with the state. Hence the contribution of the Voluntary section in India needs to be assessed in terms of the kind of innovative ideas and programmes it has been able to throw up in the light of its experiences. Within the Voluntary sector three broad trends can be identified. Some agencies are engaged primarily in providing curative services. There are others who have attempted to implement the concept of Primary Health Care by also including programmes aimed at community participation and preventive care. A third set has taken up broader issues like land relations, agricultural wages, power structures in village communities etc. in addition to health issues.

The latter two trends have come up with alternate models for primary health care. Unfortunately very few of them are such as can be replicated under different conditions all over the country. The reasons for this are many, but some may be highlighted. Most agencies depend heavily on the drive and initiative of 2-3 individuals. As replicability is not seen as a priority, little thinking has gone into formulating strategies that do not depend on the quality of a 2-3 project leaders. The costs involved, sources of funding and their impact on replicability have also not been worked out. Another notable trend is that, in looking for alternate models, emphasis has been on "parallel" structures and mechanisms outside the state run PHC structures - i.e. the outlook is to build new structures to by pass or even run counter to the existing health delivery network. For nationwide impact, such an enterprise would neither be successful nor desirable. Further, such fundamentally different structures may in fact be envisaged only under alternative socio economic structures and this, of course, is why the need is felt by some health groups to engage themselves in taking up socio economic issues also.

PSM organisations, too, hold that fundamental socio-economic transformations are necessary for a rational health policy and, in general, for benefits of science & technology to be socially equitable. But, rather than wait for these transformation or working in the purely socio-political domain, PSM organizations work both to promote greater consciousness about the issue and to creat working "models" - i.e. viable and replicable structures with the potential for becoming nationwide alternative policies and implementation mechanisms. In

the health sector, as perhaps in education too, this would necessarily involve working, in a broad sense, within existing institutional & other structures and looking for alternative models & mechanisms for the State Health Delivery System, with well-defined roles for PSM and other peoples' organisations.

ROLE OF AIPSN

The AIPSN has the potential for intervening in a meaningful way in the health sector. It has the twin advantage of having an All India reach and a relative homogeneity of purpose and approach. There is also the in-built scope for exchange of views among constituent organisations. Moreover already existing linkages with organisations of medical and para - medical personnal can be strengthened. Such advantages confer on the AIPSN the necessary impetus to overcome many of the shortcomings of voluntary agencies cited above. The broad direction of the AIPSN's involvement in health should be along the following lines:

— Policy issues : Work out its perspective on Health Policy, Drug Policy etc. A campaign aimed at the policy makers can be planned based on this perspective.

— Mass campaigns : Based on the AIPSN's basic understanding regarding health some fundamental demands need to be formulated. These can be taken up as campaign issues among the general public. Given the nascent stage of development of the Peoples Science Movement in most stages, the campaign should be focused on a few key demands.

— Linkages with health delivery personnel : Linkages need to be built with organisation of doctors, para-medical personnel, medical representatives etc. Such linkages can work also to attract these sections, involved in health care delivery, to the Peoples Science Movement.

— Models for Primary Health Care : Initially in a few selected areas the AIPSN should develop models for Primary Health Care. Based on the experience gained strategies for replication can be worked out.

The most problematic area in the Health Care Delivery system in the country is the interface between the PHC system and the users of this system i.e. village communities. The AIPSN can have a major role to play in this area. It can play the catalysing role in making the PHC system more answerable to the community. It can also work towards sensitising communities to issues related to health, so that

instead of being passive recepients of Government services they can involve themselves in the decision making process. Such interventions also require democratisation of the political and administrative set up, with much greater powers being reserved for local bodies right down to the panchayat samities. Here again the AIPSN can play a major role in association with local democratic organisations of the people. Given such a perspective the AIPSN, with its All India reach, is in a position to work out models for Primary Health Care which can be replicated all over the country.

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This paper was presented by Dr.Amit Sen Gupta on behalf of the Delhi Science Forum, at the second All India People's Science Congress. The Delhi Science Forum has played a major role in PSMs by their theoretical writings, their various critiques of developmental policies and their nodel role in many all-India campaigns. Their accurate investigative reporting and analysis of the Bhopal gas disaster and its causes was a major contribution not only to the fight for Justice at Bhopal but to the entire PSM movement.

THE CRISIS IN MEDICAL CARE

Dr. B.EKBAL.

The medical profession along with other sphere of the society both in the developed and developing countries outside the socialist block is in the grip of a severe crisis. The relevence of the present health delivery system in the developing countries and its limitations in meeting the health problems of the developed countries, are being discussed in several circles. The role of multi-national drug firms and the unethical and antipeople policies followed by them are subjected to severe criticism. These modern trends are making their impact in the medical profession also and the medical profession itself has started what is described as "a house cleaning campaign". Rising cost of medical care, increase in the incidence of Iatrogenic diseases, the inability of the modern medicine to contain the major killers in the developed and developing countries, the technological supremacy and its dehumanising effects and the role of multinational drug companies are some of the facets of the deepening crisis of the modern medicine.

A number of explanations are offered to explain away this crisis. A number of books are written and a number of remedies to solve the crisis are advocated. Attempts to demystify the medical profession are being made by several workers. These attempts and the alternatives suggested vary from sheer "reformism", to ideologies that are definitely radical in content. It is our duty to study these crisis in its totality and to understand it as part of the socio-economic crisis produced by advanced capitalism and offer democratic revolutionary alternatives.

The health care activities are now being used by social and political workers as entry points into a community in various parts of the world including our country, because of the readily acceptable nature of the health care activities by the people. After entering the community, the health worker/Doctor acts as a change agent who initiates a desired social change. These desired changes vary from evangelisation as being practiced by Christian Missionaries or radical socio-economic changes as exemplified by the activities of CheGuvera and Allende in Latin America. This revolutionary and reformist roles of health Worker/Doctor as change agent should be studied by us.

I feel that the two areas which offer tremendous potentialities for the democratic forces are -

1) the crisis of modern medicine as part of the general crisis of advanced capitalism and the possibilities to offer radical alternatives to the present crisis ridden medical care system;

ii) the role of health worker/Doctor as a change agent for initiating radical revolutionary activities in a community with the help of health care activities.

Here, I would like to examine some of the present ideological basis of the medical profession. The tendency of the part of the medical profession is to treat health as a purely individual or personal biological phenomenon, whose problems are to be solved at the individual level through medical technology. The slightest scraping of the surface of this notion, reveals the fabric of health with its interwoven biological, physical, social, economic and political threads. To understand health issues we must first explore some of the prevailing myths around the concept of health, health services and their evolution. The generally accepted belief that health is biologically determined and medical technology is an outcome of objective value free science needs further analysis.

It is seen that depending upon the available knowledge and consciousness of the people and the culture of the dominant class the concept of health and the approach to health problems popularly accepted varies from time to time. Historically from the magicoreligious overtones of the earlier epochs, the concept of health evolved into a more scientific one. The initial multi-dimensional approach to health, however, got lost in the mechanical model of the industrial era. This naturally led to the individualistic and curative approach to health problems where medical technology alone was considered sufficient to handle the problem. The limitations of this approach brought back the environmental or the ecological approach to health. It was conceded that the health or physical status of the individuals and groups is largely determined by their social, biological and physical environment.

Inspite of this, however, the emphasis on the biological basis of health continued with little effort to bring out the significance of its social basis. The contradictions of the capitalist health service system, the growing class consciousness of the working class and the establishment of a more egalitarian health service in the socialist countries have finally brought the social dimensions of health into focus.

The health services are used by the ruling classes for procuring efficient labour and for investing their capital into health industry. This brings them high profits and also give respectability to the social system. As capitalism progresses and leaves increasingly dire health hazards in its wake, the technologically oriented system of medicine tends to mask the origins of the morbidity by treating illness as an individual disorder through the use and purchase of commodities. Because in the capitalist system the health service itself is converted into health industry and 'Health' is treated as a commodity that can be purchased from the market at a price.

There has been increasing evidence of occupationally and environmentally induced cancers and indications are that they will continue to increase with growing suspicion about the definite or suspected carcinogenocity of wide variety of occupational chemicals, environmental pollutants and food additives. Based on the available date from the Western Industrialised Societies environmental factors are the cause of approximately 80% of all cancers. By labelling people into the Medical categories of 'diseased', 'handicapped' and 'retarded' health services in the capitalist countries hide the real nature of the social system which leads on to these problems.

The crisis of capitalist mode of production as the real cause of most of the diseases in the developed countries is now increasingly being recognised. Psycho - somatic diseases for example, are produced by the 'internalisation of alienation' which is the result of capitalist mode of production. Along with other institutions such as educational system, mass media and organised religion, medicine promulgates an ideology that helps maintain a class structure and pattern of domination.

The majority of the under developed capitalist countries were colonised by the imperialist powers which brought with them their own western system of medicine. Since the main interest of the western imperialist powers was to expropriate local resources in order to enrich their own economies, the growth of western medicine in these countries was not only not backed by a general betterment of the living conditions but was accompanied by the definite, disruption of the economic and social life of the people. The result was that undernutrition and insanitary conditions which promoted diseases became prevalent and so communicable diseases continued to persist together with nutritional diseases. They constituted the major causes of ill health in these countries. The patronge given to western medicine by the governments gradually destroyed the local system of

medicine and thus further deprived the common man of any kind of health care.

After their liberation the national governments of these countries because of their class charcter did little to retrieve the situation. They also used the health service system for exactly the same purpose as their former masters, as an avenue for profit making, a sop to quieten the rising unrest of the people and a tool of cultural domination.

The developments in the health field during the period of India's colonisation follow the same trends as discussed for the third world in general. The second half of the nineteenth century, saw the gradual decline of Ayurvedic and Unani Prac ces and the laying of the foundation of western medicine through British Missionaries, philanthrophists, and the state. By 1940s' the western concepts of health care, the clinical and curative approaches to medical problems based on modern medical technology and the supremacy of the physicians in decision making had taken roots among the upper classes. After 1947, like all other sectors, the health sector also settled down for development within the capitalist frame-work. This mea that instead of taking care of the social dimensions of health problems and developing a people oriented service and moulding medical technology to suit the needs of the people, the health sector under the banner of welfare service became a supportive structure for the profit making machinery for the ruling classes. The health sector became an instrument for attracting foreign aid and patronage for the ruling class through which they could exercise technological as well cultural domination. Over the past 30 years with the health services growing within the above frame work, the majority of the people still go without any care. The lack of housing, food, and clean water has further complicated the problem.

The reason for this anomalous situation are not difficult to locate. While it is true that the number of health services, institutions, doctors and specialists have increased; their actual distribution has an urban and curative bias. At the same time, the expansion of services has mostly been due to an increase in curative services at the cost of preventive work. This is not to say that curative services are adequate today or that we are in any way against many useful high technology innovations and equipments per se. Far from it, we recognize the vital role that such advances can make to health care. But the main reasons for the crisis in health care in India does not lie in the lack of such techonological inputs.

It is imperative for any democratic health movement to examine the relevence of the present health care system and the medical education in our country. The curative-oriented, urban biased, high technology oriented and institutionalised health care is increasingly

being recognised as highly irrelevent to the needs of the country. The indigenous systems of medicine has been suppressed and neglected. The indigenous system of medicine along with the modern medical system should be utilised fully to meet the basic health needs of the people. The example of People's Republic of China stands in marked contrast to the decline of the indigenous system of medicine in our country. In China, both these system move hand in hand to solve the health needs of the people. A scientific integration of the two systems is one of the major achievements of Chinese medicine.

The role of multinational drug industry in the developing countries including India has been subjected to severe criticism recently. The Pharmaceutical Industry today is one of the most multinational of modern industries. While the huge expenditure by transnational drug manufacturers on marketing, research and development was borne by poor consumers of the developing countries it contributed little to the real health needs of the majority of the people of these countries. Drugs not authorised for sale in the countrv of origin and withdrawn from the market for reasons of safety or lack of efficiency are exported and marketed in the developing countries including India. And the third world is being used as a testing ground for new drugs developed by the nultinationals. Even though many individuals and people's science movement groups have come out to expose and attach the anti-people policies of the multinational drug companies, it is saddening to note that the medical profession at large is showing no interest in this vital issue.

The ideological content of the Medical education, the relevance of the present curative-based and urban oriented Health Care System, the role of Multinational Drug firms and Medical equipment industries, the integration of modern medicine and the indigenous system of medicine and the crisis of modern medicine are some of the areas which should be taken up for deliberation.

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PEOPLE'S SCIENCE MOVEMENTS AND SOCIAL CHANGE: SOME NOTES

By Dr.V.B. ATHREYA

The following notes on People's Science Movements (PSMs) and social change are of a very preliminary and exploratory character. This arises from the fact that the present writer is relatively new to PSMs and is basically a social scientist with specialised training in Economics and, prior to that, in Chemical Engineering. This paper is divided into four sections. In the first, which following these introductory remarks, a brief overview of the origins of PSM and their overall commitment to social change is given. In the next section, we examine the possiblility of finding some common minimum conception agenda of social change that PSMs could agree upon. We then turn to the dynamics of social change, which sets the context for the PSMs. We offer some tentative remarks on what PSMs might do in the specific context identified in the penultimate section.

I

People's Science Movements have emerged in the last several decades in several parts of the world. Academic quibbles over what constitutes a PSM need not detain us. For the purposes of our discussion, we take it that any PSM would (a) recognise the actual and potential benefits to humankind that advances in science particularly over the last two hundred years or so, have made possible. (b) be aware of the potential and actual abuse of science, (c) share the commitment that both the processes and the products of science must serve and respond to the needs of people at large, and (d) seek to involve wide sections of the people in the efforts to bring about the realisation of the commitment referred to in (e). Such a definition is of course by no means exhaustive nor necessarily free of some degree of arbitrariness, but would, in our opinion, be adequate as a starting point.

Thus most PSMs seek to propagate science and a scientific outlook among broad sections of the people, and at the same time also warn people of the havoc wrought by abuse and misuse of science in such areas as environment, health, ecology etc. They also draw attention to the new problems created by application of science and technology in various production processes, such as pollution of air and water, damage to the ozone layer, incidence of new occupation - related diseases, radiation hazards etc. But, as peoples' science movements, they recognise that solutions to these problem

must also be sought in Science, nct in the restricted sense of naturals and physical sciences alone, but in a more inclusive conception of science which accommodates social science as well.

Issues such as pollution, nuclear hazards, dangers of thermonuclear and chemical - biological holocausts, widespeard malpractices in health care etc. have often provided the impetus for the emergence of voluntary groups, starting initially with a nucleus of practising professional scientists, which seek to address these issues. The sharp and stunning paradoxes of tremendous advances in medical and life sciences on the one hand, and on the other hand, continued high rates of infant mortality, diseases of malnutrition etc; of great progress in agricultural sciences, and continued, widespread starvation and semi-starvation; of the conquest of outer space and lack of shelter for millions on earth; of the harnessing of nuclear energy and the threat of nuclear disaster - these and other contradictions between the promises of many science and the reality on the ground have made many scientists aware of the need for PSM activities. As these groups have begun to work seriously, many of them have come to realise that the solutions to the contratictions that motivated them into PSM activity are necessarily predicated upon certain fundamental social changes. It is thus that, sooner or later, PSMs are forced to confront the question of social change. Here, then, is a dialectic at work. The contradictions of scientific and technological advance within the famework of historically inherited socio - economic strcutures give rise, among other things, to People's Science Movements. These, in the course of their activity, realise the need for changes in the inherited socio - economic structures if the contradictions are to be resolved. PSMs are thus both a consequence, and in their turn, a cause of social change.

II

"Social change" is a rather broad term. In a trivial sense, any existing society necessarily undergoes "social change" of one kind or another at every moment of its existence. Clearly, however, there is a more specific sense in which one speaks of 'social change' in the context of the role of PSMs in social change. Leaving aside the differences in emphasis and nuances that would arise because of the heterogenous levels of development of various PSMs, and the differences in the specific social, political and economic environments that confront them, can one identify some characteristic social changes that all PSMs would regard as desirable? One way to proceed would be to list some important objectives that practically all PSMs would share, and then infer the kind of social change that would be conductive to the attainment of these objectives. Such a list may include:

a) Development of a critical, scientific outlook among all sections of the people.

b Democratisation of the process of production of scientific and technological knowledge.

c) Democratic control of the uses of science, and widest accessiblity of science and technology to people.

d) Use of science and technology for the benefit of working people or "science for the people"

e) Adequate safeguards against the use of science and technology to exploit or oppress nations and peoples, to destroy the earth's ecological balance, to pollute the environment, to serve the interests of wars of aggression etc.

Even such a partial list as the one above brings home a serious problem that we face: "systemic" social changes would be required to achieve many of these objectives and no PSM or even PSMs collectively can set this up as a task exclusively for themselves. They must therefore necessarily identify both the specific tasks in this process for which they would be especially suited, and the social forces who would be their allies in the larger process of social change as a whole.

III

Present-day society is undergoing unprecedentedly rapid changes. These changes are closely related to the ongoing scientific and technological revolution (STR). However, the STR itself is not taking place in a social vacuum. The inherited structure of the world economy and polity, and its division into the advanced capitalist economies of North America, Western and Northern Europe and Japan, the socialist countries and the non-socialist 'third' world, consisting mostly of erstwhile colonies of the advanced capitalist economies, constrain and condition the impact of STR, and especially the realization of its full potential. Let us briefly discuss the process of social change in a country like ours within this broad global structural context.

The forty years or so since our independence have witnessed many changes in practically all spheres: economy, education, polity, science and technology etc. We shall deal mainly with economic changes, both because we are not competent to speak of other

spheres, and because we regard these economic changes as especially important in determining the direction of social change as a whole. At the time of Independence, we had inherited a colonial economy, characterised by a very small modern industrial sector and a backward agriculture. The outstanding features of the economy was a twin monopoly: the distribution of land, the major productive asset in agriculture, was highly skewed; so were industrial assets. Further there was little of heavy and capital goods industry, and there was hardly any public sector to speak of.

The forty years of independence have seen: the growth of a sizeable modern capital goods industry in the public sector, which has played an important role in preventing a total dependence of our economy on the West; a historically significant growth of agricultural production (an average annual compound growth rate of between 2.5 and 3% from 1950 to 1985 as compared to hardly 0.5% p.a. between 1900 and 1950); the growth of a modern S&T establishment, and the emergence of what is claimed to be the world's "third largest stock of S&T manpower" building up of some indigenous capability in the areas of nuclear energy and space research; the production, within country of wide range of sophisticated modern goods, especially various electronic goods and consumer durables in the recent past.

But this is merely one side of the picture. What is the other side? The 'growth' that has occurred has meant: continued, widespread poverty (between 2/5 and 1/2 of population are poor, even by the extremely low official poverty standards, and dubious government statistics); soaring unemployment, especially among the educated, and including in its ranks a not insiginificant proportion of the "third largest stock of S&T manpower"; rapid denudation of forest cover, and despoiling of agricultural lands; widespread illiteracy, dangerous erosion of secular values, leading to the spread of the communal virus and religious fundamentalism; serious threats to national unity; persistence of obscurantist caste ideologies and barbaric practices such as sati; and grave dangers to the economic and political independence of the nation as a result of the new economic policy of increased borowings abroad, and open door to transnational giants to penetrate and control our economy, the other side of which is the downgrading of public sector and self-reliance.

The socio - economic changes described above are an inevitable outcome of the path of capitalist development followed since independence, which in practice has meant the retention of the basic

economic structure (land and industrial monopoly) inherited from colonial rule, and the implementation of **economic policy** aimed at developing productive forces through reliance on the hunger of private capital for profits, examplified by big business in industries, and capitalist landlords and rich peasants in agriculture. This strategy now faces a deep crisis; the state, given its class character, is unable to raise adequate resources for public investment, having already soaked the poor, and being unable to tax the rich it therefore seeks to privatise the economy, and to borrow heavily abroad. The foreign lenders want as their pound of flesh wide access to the Indian market; with little land reform, and hardly any job creation in industry, and the cutback in public investment, the domestic market stays stagnant; a small new market for luxury consumption goods created by the new economic policy has already run out of steam. We are rapidly moving along the road of the political economy of dependence into the debt trap of IMF and World Bank.

It is in the context of such a process of social change that we have to address the question of the role of PSM's in social change.

IV

In our view, the political economy of social change in India sketched out in the last section, must be understood by PSMs if they are to effectively intervene in the process of social change to acheive their objectives. What are some of the implication of this political economy for PSMs?

It alerts us to the fact that, for full realisation of the potential benefits of STR, two impediments have to be overcome. Internally, the presence of land monopoly and the consequent persistnent strength of caste and other pre-modern obscurantist ideologies and practices, is a major obstacle. Externally, increasing penetration of our country by foreign big capital and the consequent subverting of the process of development of self reliant science and technology, is a major impediment.

Any PSM, therefore, would have to oppose:

a) Land monopoly and the associated material and ideological social relations and practices. This would mean a principled fight against all forms of superstition and obscurantism, whether clothed in the garb of religious or caste ideologies/ practices or in the garb of various social customs and material practices such as, for instance, those that serve to oppress women. This is to be understood as primarily struggle against harmful material

practices; to put the primary stress on 'fighting- unscientific but harmless individual beliefs would be to get diverted, and would also reflect a failure to understand the material basis of such beliefs.

b) Penetration of transnational capital into the country and increasing dependence of the economy on the advanced capitalist economies. This would mean a commitment to self-reliance. Here, self-reliance does not mean complete autarchy or non-participation in the international division of labour. It means rather, the ensuring of an independent industrial and economic base. This means, in particular the need to ensure independent scientific and techological advance that both keeps itself abreast of international developments and answers the specific needs of our national economy. It means a fight against the dismantling of the public sector, and against a model of development that seeks to derive its impetus for growth from the import-intensive luxury consumption of a narrow stratum of the population.

An examination of the perspectives implicit in the theory and practice of the contingents of the PSM in India would suggest that some of them have tended to highlight the external factor (role of colonialism and neo-colonialism) while some others have focused almost exclusively on the internal aspect (role of pre-capitalist economic and social relations). In the case of some, even the understanding of the internal aspect is not from a scientific-materialist standpoint but rather an idealist view (eg. crude rationalism which seeks directly to attack and demolish superstitious and religious" ideas and conceptions," without recognishing their material basis or similar idealist conceptions of caste structures and caste relations). Similarly, in the case of some contingents which stress the external factor, this factor is not grasped as an aspect of production relations and of the sphere of production as a whole, but in a 'consumerist' manner (eg. the role of transnational corporations in the area of drugs or the role of imitative consumption patterns as an obstacle to self reliance). In our view, both the external and internal aspects have to be grasped in terms of the sphere of production, and circulation as a whole, or to put it in a different way, in terms of their implications for the development of both forces and relations of production.

The above comments are, or course, at a rather general and abstract level. They are certainly not intended to imply that every activity of PSMs has to be directly geared to the overcoming of the

twin aspects external and internal - responsible for the present state of all - round crisis in economy and polity, and by implication, in the arena of science and technology as well. PSMs do, after all, operate at a microlevel both in the spatial (geographical) sense and in the sectoral sense (eg. education or health, environment or energy etc) In such sector - and region - specific micro activities, a great deal of experience has been accumulated by various PSMs. It is only by summing up this experience, and assessing the wider replicability of its various components, either directly or in modified forms, that the PSM in India can move forward in the direction of progressive social change. The sketchy analysis of the political economy of social change is intended to provide a perspective within which such summing up and assessment could take place and the next stage of advance planned for.

This paper was presented at the first all India Peoples' Science Congress held at cannanore in February 1988. Dr. V.B. Athreya graduated in chemical engineering and then got his Ph.D. in economics in the U.S. He has since been teaching economics in Bharatidasan University where at present he is a professor. His work and innumerable publications on political economy earned him recognition as an outstanding progressive economist. He is also president of the Tamil Nadu Science Forum.

It is time
to start a liberation struggle,
liberation from dependence,
liberation from ignorance,
liberation from mistrust and hatred,
It has to be a self - reliance movement,
a literacy movement,
a unity movement.